ABSTRACT

Title of dissertation: HOUSEHOLD RESPONSES TO POLICY AND SOCIAL NORMS IN INDIA

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In this dissertation, I study two of India's key social challenges: combating hunger and reducing gender inequality in education. Chapter one describes the background and context for both challenges and provides an overview of the methodology and results from the empirical analysis.

In chapter two, I use household survey data to examine the effect of food subsidies on the nutritional outcomes of poor households in India. The national food security program, known as the Public Distribution System, provides a monthly quota of cereals at substantially discounted prices. I study the effect of the program by exploiting geographic and household size specific variations in the value of the subsidy resulting from differences in state program rules and local market prices. I find elasticities for cereal consumption and caloric intake with respect to the subsidy that are small, but higher than estimates from prior literature on food subsidies. The elasticities for calories from all food groups are positive and significant. Thus

households benefit from the program in terms of overall food intake and not just through cereals. I find a smaller effect in states that have higher levels of corruption. Finally, I use the estimates to simulate the caloric impact of the new National Food Security Bill.

Gender discrimination within the household exists in many contexts. In societies where future support is not expected from daughters, parents may be encouraged to invest even less in the human capital of girls. In India, the eldest son occupies a special position as the family heir and assumes responsibility for parents' welfare in their old age. In chapter three, I explore whether part of the observed pro-male bias in educational expenditures and school enrollment can be explained by parents choosing to invest in the (male) child that is the most likely to provide for them in the future. I confirm the presence of a pro-male bias and an additional preference for the likely inheritor in educational expenditures and enrollment. In families with more children and greater competition for resources, the inheritor bias is greater. I also find evidence suggesting discrimination against sons in the state of Meghalaya which follows a matrilineal system where the youngest daughter is the family heir.

HOUSEHOLD RESPONSES TO POLICY AND SOCIAL NORMS IN INDIA

by

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Chapter 1: Introduction

As one of today's emerging economies, India faces multiple economic and social hurdles. The economy has experienced a relatively fast rate of growth over the past decade yet inequality is high and a large proportion of the population remains vulnerable and in need of social protection.[1] In this dissertation, I study how households respond to policies and social norms associated with two of India's key challenges. The first challenge is combating hunger by providing food security to poor, food insecure households. The second challenge is reducing gender inequality in education by understanding the role of social norms in perpetuating gender discrimination within the household.

1.1 Hunger

The provision of food subsidies is one of the most critical forms of assistance to the poor in many countries around the world. Eradicating poverty and hunger is the first of the eight Millennium Development Goals and even today, one in every eight people in the world is hungry (FAO, IFAD and WFP 2013). The need

[1]Though on a declining trend, well over a fourth of the population (29.8 percent in 2010) continues to lie below the poverty line (Planning Commission 2012a). According to a recent OCED report, India has an above OECD average Gini coefficient of 0.38, which indicates significant levels of income inequality (OECD 2014).

for food security is greater in times of uncertainty and growing numbers of people in distressed economies report suffering from food insecurity (OECD 2014). Food subsidies are implemented in different forms via food stamps, in-kind transfers, subsidized quotas, or through pure price subsidies.

The impact of a subsidy depends critically on the mechanism through which it operates and the manner in which it is implemented. The literature on the nutritional implications of these subsidies finds their impact to be quite small, in some cases even negative (Jensen and Miller 2011). In chapter two, I add to this literature by studying the mechanism and consequent impact on nutrition of one of the world's largest food subsidy programs, the Indian Public Distribution System.

The Public Distribution System (PDS) is the Indian government's flagship food security program. It accounts for almost one percent of the country's GDP and is currently used by 44.5 percent of the population (Planning Commission 2012b). The PDS assures a fixed quantity of cereals, sugar and kerosene to poor households every month at substantially discounted prices. It is intended as a supplementary program to improve the nutritional status of food insecure households. The central government procures cereals from farmers and distributes these grains to beneficiaries in different states via a network of 489,000 fair price (ration) shops.

The need to provide food security is particularly pressing in India. The seasonal nature of agriculture and dependence on the monsoons makes a large fraction of the population vulnerable to food scarcity. Based on the 2011-12 Gallup World Poll, as high as 16.3 percent of Indian respondents reported having faced food insecurity over the last twelve months (OECD 2014). This is higher than the BRIC average of 15.1 percent and the OECD average of 13.2 percent. Of the 40 countries included in the poll, India had the 14th highest prevalence of food insecurity. According to NSSO consumption data, more than three quarters of the country's population routinely consumes less than the minimum caloric requirements (Deaton and Drèze 2009). The PDS aims to address this issue by providing supplementary food grains to vulnerable households.

The PDS has its origins in the system of rationing put in place by the British Government in 1939 to deal with rising prices in Bombay. The system was intended as a means to curb inflation and distribute food grains equitably in times of scarcity, primarily in urban areas. In 1942, the Department of Food was set up to deal with procurement and distribution of publicly provided food grains. This was a precursor to the creation of the Public Distribution System. In the early years of India's independence, the PDS played an important role in controlling prices and imports, and distributing grains across surplus and deficit areas. With the Green Revolution, India achieved food self-sufficiency and the Food Corporation of India was created to manage the large-scale procurement, storage and distribution of food grains. In the 1980s, the scope and reach of the PDS were extended and the central government started to provide other essential commodities such as sugar, edible oil and cooking fuel through an extended network of fair price shops in both rural and urban areas.

State governments were given the option of adding to the goods provided through the PDS under the Essential Supplies Program of 1982 (Planning Commission 2005).

Until 1992, all households in the country were eligible to purchase food grains and other commodities at fair price shops. Ration cards were issued to all households and served the dual purpose of providing access to the PDS and being a government approved form of identification. The Revamped Public Distribution System in 1992 introduced geographic targeting and eventually made way for the Targeted Public Distribution System in 1997. Under the new program, below poverty line (BPL) households were identified and made eligible for 10 kg of food grains every month at substantially discounted prices. The aggregate number of BPL households for every state in India was determined based on poverty estimates by the Planning Commission. State and local governments were made responsible for carrying out periodic surveys to determine which households would be eligible for the program. The price subsidy for above poverty line (APL) households was removed, though they continued to have the right to purchase PDS food grains at market prices. The monthly allocation for BPL households was increased to 20 kg of food grains per month in 2000, and the Antyodaya Anna Yojana was introduced to provide an additional subsidy to 10 million 'poorest of poor' households. The monthly quotas were further revised to 35 kg in 2002 for many states.[2]

Determining BPL status, and subsequent eligibility for the PDS, has been a con-

[2] Table 2.1 describes state level quotas and program rules for the period 2002-2008.

tentious issue in India. While the central government provides a cap on the total number of poor households in every state, state government surveys determine actual eligibility and have employed a number of different methodologies over the years to identify the poor. Many believe that the central government provides too low an estimate of the number of poor households and that the consumption basket used to determine the poverty line is no longer relevant. In particular, the costs of non-food essential goods and services such as health expenditure have risen and are not adequately accounted for (Karat 2010). Methodological issues aside, the errors of exclusion due to faulty implementation have been found to be vary as widely as 3 percent in Andhra Pradesh to 47 percent in Assam (Planning Commission 2005). Niehaus et al. (forthcoming) find that 13 percent of legally eligible households in Karnataka do not possess a BPL card, while 70 percent of legally ineligible households do. Further, there is evidence of elite capture, which disproportionately affects certain sections of society such as the Scheduled Castes, Scheduled Tribes and Other Backward Castes. These social groups are disadvantaged due to their historically low status in Indian society and the remoteness of their location. Nagavarpu and Sekhri (2014) find that Scheduled Caste households are more likely to receive their full PDS entitlement when facing a delivery agent from the same caste.

BPL status grants access to a number of social programs including health insurance (Rashtriya Swasthya Bima Yojana), housing (Indira Awaas Yojana) and other state sponsored subsidies. Specialized schemes such as the Integrated Child Development Services and Mid-day Meals Scheme aim to improve the health and nutritional outcomes of children and the Janani Surakshya Yojana provides assistance to pregnant women. All rural households are also eligible for the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), which assures at least 100 days of employment for one adult in every household. Of the various welfare schemes in place, the Public Distribution System is by far the largest in terms of outlay and reach. In 2012-13, the projected food subsidy was Rs. 750 billion, well over the planned outlay for the MGNREGA (Rs 330 billion) and government expenditure on all social services (Rs 207 billion) (Government of India 2012). Despite the plethora of programs, inequality remains high in certain areas of the country. In a study in Bihar, Kjelsrud and Somanathan (2013) find that incorporating access to publicly provided good such as the PDS and schooling reduces overall poverty and reduces inequality within villages, but increases state level inequality as programs are not always targeted to the poorest areas.

Given the scope and scale of the PDS, it is a surprisingly under studied program. The research questions addressed in chapter two are the following: What is the impact of food subsidies on cereal consumption, caloric intake and the food basket of beneficiary households? How does the impact compare with the expenditure (income) elasticity of calories? What is the extent of loss in caloric intake due to different levels of corruption in different states? I improve upon historical estimates of the impact of the program by using two previously unexploited sources of variation in the value of the subsidy and six years of data (2002-2008) from a large nationally representative survey.

The PDS is jointly administered by the central and state governments, which results in geographic differences in the value of the subsidy provided by the program. The value of the subsidy comprises two parts, namely the total monthly allocation and the discount as a proportion of market prices. The monthly household allocation varies from 16 kg of rice in Karnataka to 35 kg in Chattisgarh. Some states such as Andhra Pradesh, Kerala and West Bengal index this allocation to family size while others do not. Thus there are differences in the quota that households are eligible for. The discount that households receive varies even within a state from one district to the next. This is a result of the government maintaining a uniform subsidized price, rather than uniform discount across regions in the country. The discounted price is typically set for the year and more importantly, is not linked in any way to fluctuations in local market prices. I combine state level program rules with data on local prices to calculate a value of the subsidy for each beneficiary household in the sample.

The results from this chapter indicate that the PDS has a positive and significant impact on cereal consumption and on total caloric intake. The gains in calories come from all food groups and not just cereals, which are directly subsidized. The elasticity of caloric intake with respect to the subsidy is lower than the income elasticity of calories. This is not unexpected, as there are transaction costs involved with using the program and leakages prevent households from receiving their full entitlement.

The PDS has been criticized for serious and significant levels of corruption and leakage. Corruption in the form of siphoning grains off to the black market is due to the commercial non-viability of fair price shops and poor monitoring of the delivery mechanism. The estimates for the proportion of food grains in the system that fail to reach their intended beneficiaries at the all-India level range from 58 percent (Planning Commission 2005) to 44 percent (Khera 2011a). At the state level, there are significant differences in the efficiency of the program. While the central government is responsible for the procurement and storage of food grains and for determining state-specific grain requirements, state-level bodies are accountable for implementation. State governments can also add to the value of the subsidy and commodities being provided. For instance, Tamil Nadu has a universal PDS where all households are eligible to receive rice at the nominal rate of Rs 2 per kg. This was a key electoral promise of the Dravida Munnettra Kazhagam (DMK) government in 2006 and has been in place ever since. In Kerala and Himachal Pradesh, the government provides other essential commodities such as lentils, spices and edible oils at discounted prices to BPL households. The southern states in India have fared much better at curbing leakages by allowing customers to verify allocations via SMS, encouraging local co-operatives to run fair price shops and ensuring easy access to the PDS by establishing better road networks and setting up mobile fair price shops.

Using estimates from Khera's (2011a) study, I classify states into those that are more versus less corrupt. I find evidence suggesting that the impact of the program is halved in states with higher levels of corruption. This has important policy implications for the National Food Security Bill, which was passed in September 2013. Under the provisions of this Bill, the PDS is set for an expansion in the value of subsidies provided as well as the number of beneficiary households it reaches, i.e. it aims to provide 5 kg of food grains per month to two-thirds of the population, at heavily subsidized prices. While some argue that expanding an already faulty system will do nothing to improve nutritional outcomes (The Indian Express, June 2013), others believe that the PDS currently excludes many vulnerable households that should be allowed to access the program (Karat 2010). A number of other issues including the fiscal feasibility of the new bill, as well as proposals for conversion of the PDS into an income transfer have been highlighted and debated extensively in the media (The Hindu, July 2013).

I add to this debate by providing an estimate of the nutritional impact of the proposed revisions to the PDS. I use the results from chapter two, combined with current data on prices and calories, to simulate the impact of the new provisions on the caloric intake of beneficiaries. While on average the bill will lead to an increase of 66-72 kcal in daily caloric intake, this will vary from state to state, depending on the levels of leakage. The results from the analysis suggest that the effect of the expanded program will be drastically reduced by inefficiencies in implementation. Most of the poorer states also have higher levels of leakage and unless corrected, these regional disparities in the effectiveness of government machinery will continue to sustain poverty traps and inequality.

1.2 Gender Inequality in Education

Gender inequality has been a part of Indian society for centuries and has it roots in a long-standing tradition of strongly patriarchal values. This has necessitated several legislations to protect the interests of women. An early example is the Hindu Widow's Remarriage Act of 1856 that legalized remarriage for widows, a practice that was considered unacceptable at the time. As evidenced by more recent laws, such as the Dowry Prohibition Act (1961), the Sati Prevention Act (1987) and the Protection of Women from Domestic Violence Act (2005), Indian women do not enjoy an equal status within the household. With daughters being considered a burden, a strong preference for sons has resulted in states such as Punjab, Uttar Pradesh and Bihar having among the most skewed sex ratios in the world (Government of India 2011a).[3] As a consequence, an estimated 37 million Indian women are 'missing' (Sen 2003). Given the prevalence of sex selective abortions and female infanticide (Arnold Kishor and Roy 2002), the Pre-Conception and Pre-Natal Diagnostics Techniques (Prohibition of Sex Selection) Act was passed in 1994. Deolalikar and Nandi (2013) find that despite imperfect implementation, the Act did play a significant role in improving the child sex ratio. After years of debate, the Hindu Succession Act was finally amended in 2005 to equate inheritance rights between sons and daughters. Though the pro-male bias in inheritance is persistent, Deininger, Goyal and Nagarajan (2010) find that the amendment increased the like-

[3] According to the 2011 Indian census, the sex ratio in India was 940 women per 1000 men. The states with the lowest ratios include Punjab (893), Uttar Pradesh (908) and Bihar (916) (Government of India 2011a).

lihood of a daughter inheriting land and also led to improved educational outcomes for women.

Given the unequal status of sons and daughters, it is unsurprising to find evidence of discrimination against girls in educational expenditures (Subramanian and Deaton 1991, Kingdon 2005 and Azam and Kingdon 2013).[4] While education plays a critical role in the growth and development of an individual, an unequal pattern of human capital accumulation also has economy wide implications. In a cross-country study, Klasen (2002) finds evidence that gender inequality directly lowers growth rates. Schultz (2002) argues for greater allocation of government expenditure towards girls' education for a number of reasons including higher marginal returns to education for women and evidence of strong links between mothers' education and the health and schooling of children. Though the ratio of girls to boys enrolled in primary and secondary school in India has increased from 78.7 percent in 2000 to 98.4 percent in 2011 (World Bank 2013), girls continue to receive a much lower share of resources in the form of educational expenditure.

Parental motivation to invest differentially by gender is influenced by both the supply and demand for education. On the supply side, the quality, availability and ease of access to educational facilities, particularly for girls, is an important determinant of enrollment. Evidence shows that reducing transport costs and improving facilities

[4]Section 3.1 discusses the literature on gender discrimination in other aspects of household allocation of resources in India.

encourages parents to send more girls to school. Alderman et al. (1996) observe that distance to school has a disproportionately negative impact on girls' enrollment in Pakistan and Muralidharan and Prakarsh (2013) find that facilitating access to schools by providing cycles to girls in Bihar improves attendance. The demand for education depends on costs and information available to parents, as well as the perceived returns. Programs such as the Sarva Shiksha Abhigyan and Mid-day Meals Scheme aim to reduce costs for parents and children by improving access to schools and providing nutritious meals as a further incentive. Jensen (2012) reports that a rise in the perceived returns to education for women led to improved educational outcomes for girls in Indian villages. Thus, there is evidence to suggest that parental decisions may change when the underlying factors that perpetuate gender discrimination are altered.

In chapter three, I study the role played by the social norm of partilocality (co-residence with sons) in exacerbating discrimination against girls. In Indian households, many of which comprise multiple smaller families, the eldest son enjoys a special position. He typically inherits the bulk of the family estate, is expected to take over as the head of the family and is responsible for the well being of his parents and any unmarried siblings. This is particularly true for Hindu households. It is common for sons, and in particular the eldest son, to continue to reside with his parents even after he is married. By contrast, daughters move away after marriage and are not expected to provide monetary or other assistance to their natal families. This creates differences in expectations of support based on gender of the child.

Using data on child specific educational expenditures, I study the extent to which the observed male bias can be explained by parents choosing to invest in the eldest son, i.e. the child most likely to look after them in old age. The results suggest that while son preference is persistent, accounting for the bias in favor of the eldest son reduces the overall male bias. I also check for differences across households that may be more or less likely to require and expect old age support. In agreement with the hypothesis, the bias towards the inheritor is smaller in urban areas, in non-Hindu households, in higher income households and increases as household size increases.

Finally, I examine the behavior of households in the state of Meghalaya, which is a matrilineal society where the youngest daughter inherits family property, continues to co-reside with her parents, and is responsible for their well being. Consistent with the hypothesis, parents in Meghalaya appear to favor the youngest girl in the household, and consequently I find evidence suggesting a pro-female bias in educational expenditures in this state.

The results from this chapter suggest that expectations of support in the future contribute to differences in parental investments. A recent paper by Ebenstein (2013) finds that sex ratios in Korea improved after a pension reform reduced parents' dependence on sons. Thus, with improved access to alternative forms of old age assistance such as social security and pensions, discrimination resulting from a desire for a secure future is likely to dissipate.

1.3 Conclusion

In dealing with a multiplicity of social issues, a multi-dimensional approach is required. This dissertation highlights and studies two important issues in India: food insecurity and gender inequality in education. While the two issues have independent and specific challenges, progress in one has implications for improvements in the other. The main aim of the Public Distribution System is to enhance food security for vulnerable households. Since women and girls disproportionately bear the burden of price rises and are typically tasked with collection and procurement of food for the household, improvements in the PDS will lead to improved outcomes for women. Similarly, beyond its direct effect on womens' welfare, correcting the gender imbalance in education has significant implications for the overall growth and inequality in the country.

Chapter 2: Household Responses to Food Subsidies: Evidence from India

2.1 Introduction

Provision of food security is one of the most basic forms of assistance to poor households and many governments around the world provide aid in the form of food subsidies. Despite their popularity and importance, there is a relatively small body of research studying the impact of such subsidies on nutritional outcomes. While the primary rationale for all food subsidies is reducing food insecurity (FAO 1997), their impact on nutrition (via food intake) has generally been found to be quite small, in some cases even zero or negative.[1]

Food subsidies are implemented via food stamps, price subsidies, direct in-kind transfers or through the operation of ration shops (price subsidies with a quantity cap). The mechanism through which a food subsidy operates depends on the manner

[1] Butler, Ohls and Posner (1985) find a very limited nutritional impact of the food stamps program in the United States. The Indian food security program has also historically been found to have a small impact on nutrition (Kochar 2005, Tarozzi 2005, Khera 2011c). Jensen and Miller (2011) find a negative impact of price subsidies on caloric intake in China. There is also a literature comparing the effects of food subsidies and income transfers. Hoynes and Schanzenbach (2009) find that the food stamps program in the United States has the same impact on food expenditure as cash. Steifel and Alderman (2006) and Laderchi (2001) find similar results in Peru where the impact of food subsidies on child nutrition is no different than that of cash transfers.

in which the program affects income and prices (and the related elasticities of the demand for food), the specific types of food groups it targets (and the income and cross price elasticities of other foods), and how close the beneficiary households are to their ideal level of food consumption. This paper examines India's food security program, the Public Distribution System (PDS). The PDS is one of the country's biggest anti-poverty programs. It has a target population of 65.2 million households and the total cost of food subsidies amounts to almost 1% of GDP (Planning Commission 2012b).

The PDS provides a monthly quota of cereals (20-35 kg per household) at substantially discounted prices to households that are below the poverty line (Government of India 2011b). The poverty line in India is determined by having an income deemed adequate to purchase a basic minimum level of calories.[2] Since cereals are relatively cheap and rich in energy, they account for a substantial proportion of the total calories consumed by poor households.[3] Thus the PDS aims to directly increase caloric intake by providing supplementary cereals to poor households, who are, by assumption, food insecure. The program may, however, have consequences in terms of consumption of other food groups which are critical to maintaining a healthy and balanced diet. This is particularly important in India where the levels of

[2] Deaton and Drèze (2009) find that the average caloric intake in India has declined over time. However, they note that this declining trend does not undermine the importance of reducing calorie deficiencies for poor households. In my sample, the caloric intake of the below poverty line (BPL) population is well below the minimum caloric norms (and the calories consumed by more affluent households). See Table 2.4 ahead.

[3] Cereals account for over 72% of the total calories consumed by BPL households in the sample under study (Table 2.4) .

child malnutrition are alarmingly high and have been linked to severe micronutrient deficiencies (Banerjee and Duflo 2011). Thus it is necessary to study the impact of the program not just on the intake of cereals and total calories, but also on calories from different food groups.[4]

The value of the subsidy to a household is a function of the quantity cap and the discount (difference between the market and PDS price of cereals) that the household is eligible for. This paper uses two previously unexploited sources of variation in the value of the subsidy to measure its impact on nutritional outcomes. First, the total quantity cap for each household varies by state since the program is jointly funded by the state and central governments. Further, some states index the cap by family size and others offer a fixed quantity to every household. This results in variation, even within state, in the per person quantity cap, due to differences in family size. Second, the price charged for PDS goods is typically set for the year and not linked in any way to fluctuations in market prices. Due to the absence of perfectly integrated agricultural markets and controls on the movement of goods within the country, the difference between the PDS and market price within a year varies substantially across districts (within a state) and seasons.

[4]While the links between improvements in caloric intake and health outcomes certainly exist, the relationship is not necessarily linear and depends critically on other factors such as a balanced diet, activity levels, sanitation, and basic medical facilities (Deaton and Drèze 2009). In the absence of data on health outcomes in my dataset, I am unable to predict the impact of the subsidy on health. However, assessing the impact on caloric intake is important in itself. Reducing the incidence of hunger by improving caloric intake for a food insecure population, such as BPL households in India, is among the major humanitarian goals of many governments and international organisations around the world.

State level program rules and differences in local market prices are used to compute the value of the subsidy for each beneficiary household, based on its size and district-season-year cell. This value is used to identify the effect of the subsidy, assuming that after controlling for household characteristics, district, state-year and seasonal effects, the remaining variation in the value of the subsidy (owing to unpredictable fluctuations in local market prices and differences in the per person quantity cap due to family size) is exogenous. The consumption data come from six years (2002-2008) of the nationally representative socio-economic surveys conducted by the National Sample Survey Organisation (NSSO). The analysis focusses on eight major states in India where rice is the primary staple. The main outcomes studied are cereal consumption, caloric intake, calories from different food groups, and total food expenditure. In order to compare the estimates with prior work on expenditure and income elasticities, supplementary data on income and consumption from a smaller but much richer dataset, the India Human Development Survey (2004-05), is used.

The estimated elasticities of cereal consumption and calories with respect to the value of the subsidy are small, but higher than previous estimates – the elasticity of caloric intake with respect to the value of the subsidy is 0.144, as compared to 0.06 in Kochar (2005). An increase in the rupee value of the subsidy increases calories by more than twice of what is implied by its impact on cereal consumption alone. This is an important indicator that households benefit from the program in terms of overall caloric intake and not just through the cereals directly provided by the

PDS. Even though the program subsidizes only cereals, it has a positive effect on the consumption of all types of food: the impact on calories for all food groups is positive and significant. In comparison, Jensen and Miller (2011) find a zero or negative effect of pure price subsidies for rice on overall calories and calories from different food groups in China. Their study estimates the effect of changes to the price paid for every unit of the staple food while the PDS in India is similar to an income transfer, implying a parallel shift of the budget set. Since the two studies analyse different margins of adjustment, I do not expect the same responses and the difference in results suggests that food subsidies in the form of income transfers may be less susceptible to unintended negative consequences on caloric intake, as compared with pure price subsidies. Results are robust to alternative specifications of the value of the subsidy and the impact of the program on non beneficiary households is examined and found to be small.

State level differences in the administration of the PDS are taken into account using evidence on program fidelity from Khera (2011a). As expected, the subsidy has a substantially smaller impact in those states where the illegal diversion of food grains away from their intended beneficiaries is reported to be high. Despite serious implementation issues, the PDS continues to be one of the government's biggest anti-poverty programs and an expansion of the system is imminent under the National Food Security Bill, which was passed in September 2013. The bill will expand both the reach, and the value of subsidies provided through the PDS. The elasticity estimates from this paper, combined with current data on prices, suggest that the increase in the value of the subsidy under the provisions of the bill will lead to an increase of 66 - 72 kcal in the daily caloric intake of current beneficiaries of the program. These gains will be much higher if states are able to successfully reduce leakages from the PDS.

The chapter is organized as follows: Section 2.2 describes the functioning, history and rules of the Public Distribution System in India. The motivation is described in section 2.3, which comprises the conceptual framework and a review of the related literature. The data, empirical specification and descriptive statistics are presented in section 2.4 and section 2.5 discusses the results. The final section concludes and describes avenues for future work.

2.2 The Public Distribution System in India

The Public Distribution System was established in India in 1939 by the then British government to cope with rising food prices and food shortages in Bombay and other urban areas. Over the years it expanded its scope dramatically and is currently one of the Indian governments most significant welfare programs. In the 2012-13 central government budget, the food subsidy was projected at Rs 750 billion (approximately US$13.8 billion, Government of India 2012). The PDS provides a minimum support price to farmers and acts as a food safety net for the rural and urban poor. It works alongside the free market and provides rice, wheat, edible oils, sugar and kerosene at subsidized prices through 489,000 fair price shops across the country (Planning Commission 2012b).

Prior to 1997, any household could purchase a monthly quota of subsidized products at fair price shops. In 1997, there was a major change in the PDS with the introduction of the Targeted Public Distribution System (TPDS). Under the new system, families classified as being below the poverty line (BPL) could get 10 kg of food grains per month at half the economic cost to the central government of procuring them. This quota was increased in 2000 to 20 kg per month (rice and/or wheat) and in 2002, the quota was revised upwards to 35 kg for most states. The subsidy for above poverty line (APL) families was eliminated.[5] Table 2.1 presents the details of state specific quotas for the period 2002-2008. Kochar (2005) estimates that the value of the subsidy, defined as the product of the quantity entitlement and the difference between the market and PDS price, increased from Rs 7 per household per month in 1993 to Rs 48 per household per month in 2000 (an increase of over 500%). Thus the TPDS introduced targeting and substantially increased the subsidy for BPL families. Currently, PDS prices are fixed by the central government and state governments are only allowed to add limited transportation costs and taxes. PDS prices are not indexed in any way to market prices. 24.3 million households classified as Antyodaya (poorest of the poor) are entitled to a larger quota and still lower prices. The next big change in the PDS is imminent as per the provisions of the National Food Security Bill, which was passed in September 2013. This bill

[5] Tamil Nadu continues to have a universal subsidy and, since June 2011, provides 20 kg of rice per month free of cost to BPL households.

makes it a legal right for 67% of the population to obtain 5 kg of foodgrains (per person per month) at prices between Re 1 and Rs 3 per kilogram. The eldest woman in the household will be given access to the subsidy on behalf of her family (The Hindu, July 2013). The resulting expansion in the reach and value of subsidies provided through the PDS could make it the largest food security program in the world.

The PDS is an essential part of the social framework in many areas of the country, particularly places with limited access to markets. However, the implementation of the program has been called into question on a number of dimensions.[6] The first is the targeting accuracy of the PDS post 1997. Local governments are responsible for periodically carrying out surveys to assign poverty scores to households. The central government provides a cap on the number of BPL households for each state. State governments translate these caps into cut offs for the poverty score. All households that fall below their respective state- and district-specific cut off are classified as being below the poverty line and are issued BPL cards (Karat 2013 and Dreze and Khera 2010). In 2002, the BPL survey comprised 13 questions related to educational status, asset holdings, indebtedness, demographics etc. Targeting leads to errors of inclusion and exclusion. The reported rate of exclusion (eligible households without a BPL card) varies from 3% in Andhra Pradesh to 47% in Assam (Planning Commission 2005). In an independent study on Rajasthan, Khera (2008) finds an exclusion error of 44%. Swaminathan (2008) also reports high rates of exclusion,

[6] A discussion of how the analysis deals with these implementation issues is presented in sections 3.3 and 5.5.

particularly in states like Kerala that switched from a universal PDS. Kochar (2005) argues that targeting reduced political support for the program.

The second issue is corruption in the PDS, particularly through diversion of food grains at different points along the distribution chain. This has been often highlighted in newspaper editorials, magazines, government reports and journals, though accurate estimates are difficult to obtain. The Planning Commission (2005) estimates that the government of India spends Rs 3.65 to get Re 1 worth of subsidy to a BPL household. Based on a survey conducted in 2001, the report concluded that 58% of food grains procured by PDS did not reach their intended beneficiaries due to a combination of inaccurate targeting and diversion. Khera (2011a) puts this number at 44% in 2007-08 by comparing official figures for food grains distributed through the PDS, with data on purchases from household surveys. She divides states into those that are functioning, reforming, or languishing in terms of the average quantity of food grains reaching households. Of late, significant state level differences in the working of the PDS have emerged and some states are improving delivery. A nine state survey by Khera (2011b) conducted in May and June 2011 finds that over 85% of the monthly entitlement was received by beneficiaries in these states. In November 2012, the Indian government announced that a number of subsidy programs such as scholarships, cooking fuel subsidies, pensions and unemployment benefits would be converted into direct cash transfers in a phased manner starting in January 2013. This move is an attempt to reduce inefficiencies and corruption in the implementation of various welfare schemes. Food grains in the

PDS are not yet a part of the proposed switch but some states, such as Bihar, Madhya Pradesh and Delhi, are conducting pilot studies and have expressed an interest in making that change.

2.3 Motivation

2.3.1 Conceptual Framework

A price discount with a quantity cap is typically represented by an outward shift of the budget constraint. Figure 2.1 presents this shift in the household budget set with food on the horizontal axis and the rupee value of non-food consumption on the vertical axis. Let the price of non food purchases be normalized to Re 1. A subsidy comprising a discount of δ and a quota Q shifts the budget set from NF to NCD. As demonstrated in Moffitt (1989) and Deaton (1984), the household will choose segment I if its indifference curve is tangent at any point (say, A) on the segment CD and a similar argument holds for tangency on segment II. If tangency is not achieved on either segment, the household will choose the kink C. The food subsidy program in India varies geographically and by family size in the amount of the quota, the discount and the resulting value of the subsidy. Following Kochar (2005) and Khera (2011c), these program rules are presented below by slightly modifying the standard utility maximization problem.

Let the utility function for household i be $U_i = f((1-\alpha)x_i + y_i, z_i; T_i)$, where x_i represents the subsidized food, y_i represents food purchased from the market,

z_i is non-food purchases and T_i denotes tastes which could depend on age, gender, composition and other household characteristics. The subsidized and market food purchases are substitutes and α $(0 \leq \alpha \leq 1)$ represents any (multiplicative) transaction costs associated with buying the former. Let p_x, p_y and p_z be the prices faced by the household where $p_x = (1-\delta)p_y$ with δ being the discount $(0 \leq \delta \leq 1)$. Let Q be the quota and M_i the household income. The household's maximization problem is:

$$\max_{x_i, y_i, z_i} f((1-\alpha)x_i + y_i, z_i; T_i)$$

subject to:

$$\begin{aligned} p_x x_i + p_y y_i + p_z z_i &\leq M_i \\ x_i &\leq Q \\ x_i \geq 0, y_i \geq 0, z_i &\geq 0 \end{aligned}$$

The resulting Lagrangian is:

$$\begin{aligned} \mathcal{L} = \max_{x_i, y_i, z_i, \lambda, \gamma, \mu_1, \mu_2, \mu_3} f((1-\alpha)x_i + y_i, z_i; T_i) + \lambda(M_i - p_x x_i - p_y y_i - p_z z_i) \\ + \gamma(Q - x_i) + \mu_1 x_i + \mu_2 y_i + \mu_3 z_i \end{aligned}$$

Solving the first order conditions provides the demand functions for specific parameter values. The solution (x_i^*, y_i^*, z_i^*) will belong to one of the following four cases.

Case 1 : $x_i^* = 0, y_i^* \geq 0, z_i^* \geq 0$

$$\alpha > \delta, \frac{MU_y}{MU_z} = \frac{p_y}{p_z} \text{ (First order conditions)}$$

Transaction costs (α) far outweigh the discount benefit (δ) and the household does not make any purchases from the PDS (i.e. non participation).

Case 2 : $0 < x_i^* < Q, y_i^* = 0, z_i^* \geq 0$

$$\alpha < \delta, \frac{MU_x}{MU_z} = \frac{p_x}{p_z} \text{ (First order conditions)}$$

The household meets its entire food requirement through the PDS and does not need to make any purchases from the market. This case is represented by point B in Figure 2.1.

Case 3 : $x_i^* = Q, y_i^* = 0, z_i^* \geq 0$

$$\alpha < \delta, \frac{MU_x}{MU_z} > \frac{p_x}{p_z}, \frac{MU_y}{MU_z} < \frac{p_y}{p_z} \text{ (First order conditions)}$$

The household would like to purchase more food at the discounted rate, but not at the market price. This case refers to point C in Figure 2.1, i.e. locating exactly at the kink.

Case 4 : $x_i^* = Q, y_i^* > 0, z_i^* \geq 0$

$$\alpha < \delta, \frac{MU_y}{MU_z} = \frac{p_y}{p_z} \text{ (First order conditions)}$$

The quota is binding and the household supplements its food with market purchases.

This is represented by point A in Figure 2.1. Note that voluntary under-purchase, where $0 < x_i^* < Q$ and $y_i^* > 0$ could take place if $\alpha = \delta$. However, this will never occur if there is even an infinitely small (ϵ) fixed cost associated with going to the fair price shop and thus, under-purchase is likely driven by supply issues and collapses to case 4.

2.3.2 Expected Effect of the PDS

Post 1997, both the discount and the quantity cap in the PDS for BPL families were substantially increased. Khera (2011c) finds that participation in the program has dramatically risen since the early 2000's. She confirms that the conditions for case 1, where eligible households make no purchases from the PDS, are unlikely to be realized. Cases 2 and 3, where households make purchases from the PDS but none from the market are also unlikely to be relevant. The PDS is intended as a supplementary program and does not seek to meet the entire food requirement of beneficiary households (Government of India, 2011b). Kochar (2005) and Khera (2011c) find that the quota is low enough to necessitate supplementary purchases of food from the market for all households. The data from the NSSO surveys also confirm that cases 1-3 are not supported. As shown ahead in section 4, all PDS beneficiary households make food purchases in the market.[7]

The special case of households voluntarily under-purchasing from the PDS and buy-

[7]PDS rice expenditure accounts for less than 8% of the total food expenditure for a typical BPL household.

ing additional food in the market is also not likely to hold. Khera (2011c) finds that the quantity of cereal purchased from the PDS does not respond to income, but overall cereal purchase does. She also checks for the impact of other household characteristics on PDS purchases and finds no effect. She concludes that under purchase is largely driven by supply side issues.[8] Thus based on program rules, past studies and summary statistics, the most relevant case is 4, where the subsidy can be viewed as providing extra income to the household.[9] This extra income is given by the horizontal distance FD in Figure 2.1: $S_i = (p_y - p_x)Q$.

For a low enough quota and transaction costs less than the discount, the quota will bind and the household will purchase food and other items in the market. To see this, consider a Cobb-Douglas utility function of the form $f = ((1-\alpha)x_i + y_i)^{1/2} z_i^{1/2}$.[10] The solution to the household's problem is:

$$y_i^* = \frac{M_i - Q(2-\alpha-\delta)p_y}{2p_y}, z_i^* = \frac{M_i + Q(\delta-\alpha)p_y}{2p_z}, x_i^* = Q$$

conditional on:

$Q < \frac{M_i}{(2-\alpha-\delta)p_y}$ *(Quota < threshold value)*

$\alpha < \delta$ *(Transaction costs < discount)*

[8] In the IHDS (2005) data, of the poor households that had not accessed the PDS in the last 6 months, over 57% reported supply side constraints as the primary issue.

[9] This is also in agreement with opinions recently expressed in the popular press. Since all beneficiary households purchase additional grain from the market, Arvind Panagariya believes that the proposed expansion of the PDS will have the same effect as a cash transfer of equal value (The Times of India, June 2013). Ashok Kotwal agrees that the PDS '..is nothing but an income transfer.' (The Economic Times, June 2013).

[10] Cobb-Douglas has the unique property that the proportion of the budget spent on food will be independent of the price of other commodities.

The total food consumption ($F_i^* = y_i^* + Q$) is:

$$F_i^* = \frac{M_i + Q(\delta - \alpha)p_y}{2p_y}$$

where $\frac{\partial F_i*}{\partial Q} > 0$, $\frac{\partial F_i*}{\partial \delta} > 0$ and $\frac{\partial F_i*}{\partial \alpha} < 0$.

Thus, the total food consumption is an increasing function of the quota and discount, and a decreasing function of transaction costs. This motivates the use of a regression framework taking into account the program rules, value of the subsidy, transaction costs and tastes. Inefficiencies and corruption in the administration of the program would manifest in the form of a higher α (poor quality, long waiting time, inconvenience, distance to FPS) or a lower actual Q (supply side constraints).

2.3.3 Evidence on Food Subsidies and Nutrition

Food subsidies are an important policy tool and their impact on household outcomes such as nutrition, caloric intake, early life development and income stabilization has been examined in both developed and developing countries. The national food stamps program (FSP) in the US (renamed SNAP in 2008) has been studied extensively.[11] Between 1961-75 the program was phased in with different counties adopting it at different times. Hoynes and Schanzenbach (2009) exploit this difference in timing to evaluate the impact of the program and find that it led to an overall increase in food expenditures, as expected. Butler, Ohls and Posner

[11] See Hoynes and Schanzenbach (2009) for a review of the large literature on the food stamps program.

(1985) find very small effects of the FSP on the nutrient intake of the eligible elderly, either through stamps or cash.

Despite lower per capita incomes and greater malnutrition, most studies in the context of developing countries also find very small effects of food subsidies on nutritional outcomes. Jensen and Miller (2011) conduct an experiment in rural China to estimate the impact of price subsidies for rice and wheat and find no evidence that subsidies improve nutrition. Laderchi (2001) finds that food transfers are no more successful at improving child nutrition than other sources of income in Peru. In a survey of 300 households in Rajasthan, Khera (2011c) finds that being eligible for PDS food grains does not lead to higher overall cereal consumption. Kochar (2005) uses the change in 1997 from universal to targeted PDS to estimate the impact on calories consumed by rural households. She finds that the elasticity of caloric intake with respect to the value of the subsidy is very low (0.06 on average.) Tarozzi (2005) studies a sudden increase in the price of PDS rice in Andhra Pradesh and concludes that it did not have a big impact on nutritional status and child anthropometrics.

While the effect of the PDS on nutrition has been found to be quite small, some limitations of the identification strategies used in previous studies could cause their results to be biased in the direction of finding no effect.[12] Kochar (2005) uses variation in the value of the subsidy that is determined by BPL status. The measure

[12] Jensen and Miller (2011) raise similar concerns regarding the methodologies employed by Kochar (2005) and Tarozzi (2005).

of eligibility for the newly targeted program (BPL status) is imputed and not actually observed in the data which results in errors of mis-classification. In practice, BPL status is determined using individual poverty scores and region specific cut offs, both of which vary over time. Even within a particular region, imputing BPL status using multi-dimensional indicators of poverty is problematic. Niehaus et al. (forthcoming) survey households in Karnataka which were identified as potential PDS beneficiaries in the government BPL survey. Using the criteria for 2007 (based on eight measures), they find that 13% of eligible households do not possess a BPL card, while 70% of legally ineligible households do. Thus any exercise in imputing BPL status will have significant mis-measurement resulting in biased estimates. Further, the time frame of Kochar's study is two to three years before and after the targeted program was introduced. Take up rates were low (6%- 14%) during that time and the program was much less generous. Since 1997 and particularly during the early 2000's, the PDS has undergone enormous changes. There has been a push to increase the value of the subsidy to BPL households and participation in the PDS has gone up.[13] Finally, Kochar's analysis also suffers from a bias in the opposite direction. Since BPL status is a prerequisite for other types of government assistance, using the BPL dummy could confound the effect of the PDS with the impact

[13] Round 61 (2004-05) of the NSSO surveys provides information about the BPL status of a household. The data from this round suggest that participation is not driven by income or idiosyncratic household characteristics that could potentially affect food consumption. 68% of BPL households in 2004-05 report having accessed the PDS in the last 30 days. In data from the India Human Development Survey (2005), over 95% of BPL households report having accessed the PDS in the last 6 months. Thus, as the value of the program to BPL households has increased, there has been a corresponding increase in participation. Non-BPL participation in the PDS has fallen dramatically. In the 2004-05 round of the NSSO surveys, 0.06% of PDS users were non-BPL. This decline has also been noted by Khera (2011a). Similar behaviour has been observed in the context of other welfare programs – Brian Mc Call (1995) finds that take up of unemployment benefits increases as the individual level recipient amounts increase.

of other government programs.[14] Khera's (2011c) study also uses variation due to BPL status, and does not exploit differences in the value of the subsidy. Tarozzi's (2005) analysis focusses on anthropometrics for children below age 4; identification comes from variation in the length of exposure to higher PDS prices but does not use differences in the quantity entitlement. The length of exposure varies only from one to three months and the actual receipt of benefits is not observed. His analysis focusses on the pre-targeted PDS in 1992, when the program was much less generous. This paper adds to the literature by being the first to compute a household specific value of the subsidy using state level program rules and local market prices.

2.4 Data and Empirical Strategy

2.4.1 Data and Sample

The National Sample Survey Organisation (Ministry of Statistics and Program Implementation) has conducted socio-economic surveys every one to two years since the 1950s. The surveys are repeated cross sections and collect detailed expenditure information. They are nationally representative, conducted year round to avoid seasonal biases and form the basis for the government's official poverty estimates. The NSSO data have been used to study the PDS and other national programs such as the employment guarantee scheme as well as issues of inequality, poverty and land relations (Kochar 2005, Khera 2011a, Dutta et.al 2012, Deshpande 2000 and Sundaram and Tendulkar 2003). This paper uses six years of data from July 2002

[14] Assistance programs include loans, scholarships, medical benefits, distribution of bicycles etc.

to June 2008.[15]

The NSSO surveys split expenditure data into several sub categories such as food items, beverages, durable goods, medical expenditure, educational expenditure, conveyance and rent. Other variables include family size, number of children, industry classification of the head of the household, location, land owned, own production, type of dwelling, religion and social group. Data are collected on the age, gender, education level, marital status and relation to the head of each household member. For goods that are available through the PDS, households report spending in terms of cost and quantity separately for PDS and non-PDS sources. This enables the classification of households into PDS beneficiaries and non-beneficiaries based on actual utilization as opposed to imputing BPL status. The final analytic sample for this paper comprises the current participants of the PDS.[16]

Regional preferences for cereals are distinct and strong in India. Atkin (2013a) proposes climatic conditions and habit formation as possible reasons for these distinct tastes and previous studies on the PDS (Kochar 2005, Khera 2011c) have focussed either on rice or wheat.[17] Following the literature, I consider the eight

[15] In 2002, PDS allocations were increased from 20 kg to 35 kg per family, per month in most states. Some states started making changes (increases and decreases) in the PDS quotas in 2008. In the absence of credible official records of all the changes that ensued, I focus on the relatively stable period between 2002 and 2008 for which reliable state level program rules are available.

[16] As discussed earlier, non participation in the PDS is not likely to be driven by household specific factors. To the extent that some fraction of households with BPL cards do not avail of the program, strictly speaking, my analysis estimates the effect on eligible households that participate in the program.

[17] Jensen and Miller's (2011) results on the impact of price subsidies in China vary substantially by province suggesting that the two staples (rice and wheat) should be analysed separately. In this paper, I examine the rice subsidy and a similar analysis can be undertaken for wheat.

states (151 districts) that have rice as their dominant staple and a generous rice subsidy.[18] These states offer a very small or no subsidy for wheat. Though the main focus is on rice, the wheat subsidy in these states is used as a validity check and is found to have a very small impact. Due to data availability and reliability issues, it is standard practice to focus on the major Indian states. Tamil Nadu, a state in southern India, is distinct from the rest of the country in that it has a universal PDS. All households, irrespective of their income, are eligible for the program, making it difficult to compare their outcomes with the rest of the country since the impact at the bottom of the income distribution could be very different from its impact at the top. Thus, in the absence of a credible way to classify households into BPL and APL, and given that the program is so different in this one state, I drop Tamil Nadu from the sample. The states in the final sample are: Andhra Pradesh, Assam, Chattisgarh, Jharkhand, Karnataka, Kerala, Orissa and West Bengal. As a robustness check, I estimate the impact of the program in all the major Indian states. As expected, the rice subsidy has a much smaller impact in the non-rice favoring states. Aside from regional preferences, the rice subsidy specifically is of interest because there is some evidence that rice may be a giffen good for poor households (Jensen and Miller 2008). Finally, the rice subsidy in India is cleaner to study because the amount of illegal diversion of wheat grains is much higher (Khera 2011a).

Prices are computed using households' reported expenditures and quantities for over

[18] Honyes and Schanzenbach (2009) also restrict their sample to limited subgroups of the population that have a higher probability of participation in the food stamps program.

150 food items. For every item, prices can be determined by dividing expenditure by quantity. Though technically speaking these are unit values, which can give rise to measurement error and concerns of differentiated products in terms of quality, it is common in the literature to use them as proxies for prices (Subramaium and Deaton 1996, Kochar 2005, Atkin 2013b). In the context of this study, these issues pose much less of a threat because prices for PDS and market rice are computed by averaging the district-season-year specific price as reported by BPL households.[19] Each household is assigned this average price and not its self reported unit value. Further, only prices reported by similar households, i.e. beneficiaries of the PDS, are used to compute the local average price. Thus the local average does not include prices paid by much wealthier households, who might be purchasing higher quality rice. Following Atkin (2013a), median local prices are used to calculate the value of the subsidy as a check. The results are robust to using median prices, which are not likely to be influenced by quality and outliers. All prices are in 2005 rupees.

The conversion of food purchases into per capita caloric intake is done using standard factors (NSSO 1996) for each of the food items in the survey and total monthly household calories are converted into per capita daily amounts.[20] While this may not be ideal due to potential differences between purchases and actual intake, it is an approximation used not just in the literature, but also by the government to

[19]Every NSSO survey period (one year) is subdivived into four or six sub-rounds/waves. This is done to ensure that seasonal patterns in consumption can be studied.

[20]Subramanium and Deaton (1996) attempt to correct this conversion from the NSSO surveys to account for the number of meals given to guests. However, since there is no way to determine the composition of those meals, caloric consumption from different food groups is not adjusted and neither is the expenditure.

estimate the income poverty line based on caloric intake. [21] Deaton (1997) discusses the merits and limitations of several types of equivalence scales to convert household consumption into per person quantities. For practical applications, a simple weight is suggested as a reasonable approximation. All per capita values are thus calculated using an equivalence scale that assigns 0.5 weight for children below 15 years. This allows for a correction in the per capita amounts for larger families that are likely to have more children (who consume fewer calories).[22]

2.4.2 Variation in Value of the Subsidy

The value of the subsidy for each household is calculated as the product of the local price discount and the state specific per capita quota. The discount is the difference between the average market and average PDS price, at the district-season-year level. The quota is calculated based on program rules of the state of residence and household size.[23]

$$PerCapValSub_{ijswt} = (P^{mkt}_{jwt} - P^{pds}_{jwt}) * Q_{is}$$

where i= household, j= district, s= state, w= season, t= year and Q_{is}= state-household size specific quota for household i.

[21] As discussed in Jensen and Miller (2011), data from more detailed individual food intake diaries raise their own set of concerns of validity and accuracy.

[22] Results remain qualitatively the same if a simple per capita variable is used instead. Elasticities computed at the household level are also found to be similar.

[23] As discussed ahead, I use the national average family size to compute the value of the subsidy for every household as a robustness check.

Prices

Recall that the central government sets a PDS price for the year and states are allowed to add transport and distribution costs to the final price that households pay. The PDS price is not indexed to market prices, which are in turn determined by demand and supply side factors.[24] The diverse nature of India's terrain and climate combined with its large area results in substantial geographic variation in the prices of agricultural commodities. As discussed in Jacoby (2013), controls on the inter state trade of food grains lead to substantial differences in prices across states. Deaton (1997) finds important interregional differences in prices using NSSO data. Kochar (2005) and Atkin (2013a) ascribe the within state, inter district variation in market prices of food grains to transportation costs and state specific market controls.[25] Agricultural prices also vary by season and as a result of local conditions and unpredictable weather phenomena.[26] Thus, as a result of the government's policy of maintaining a fixed (within year) PDS price across regions in India, the difference between the market and PDS price varies for every district-season-year cell.[27]

[24]In a study conducted in Delhi, SEWA (2009) finds that 31% of respondents report that PDS prices remain low, but market prices keep rising.

[25]Wadhwa (2001) details the restrictions on the marketing and movement of agricultural goods in India.

[26]Planning Commission's (2001) extensive study on the price behaviour of rice and wheat confirms seasonality of prices. Sekhar (2003) reports a higher intra year variability in domestic agricultural prices as compared to international prices which suggests incomplete integration of markets within the country.

[27]Antyodaya households are identified as being the poorest of the poor and they pay even lower prices. In round 61 (2004-05) of the NSSO surveys and the IHDS (2005), these households are identified and summary statistics confirm that they pay 30% lower prices on average at the PDS shop (appendix Table C). They comprise less than 10 % of the BPL sample in my data. In the full dataset, it is not possible to identify these households and this source of variation is not explicitly used in the analysis. As a check, I use data from round 61 to include an interaction between the value of the subsidy and an Antyodaya dummy and find no evidence of a differential impact of the subsidy.

Table 2.2 presents the spread of the discount across and within states for different seasons. The state level average discount varies between 38% (Assam in the monsoon season) and 67% (Karnataka in winter). These rates are in line with the government's policy of offering food grains at approximately half of the procurement cost. Within any particular season and state, there is substantial variation in the district level discount. Figures 2.2 and 2.3 confirms this variation graphically for each district-season-year cell in the sample. Panel A plots the discount data from 2002 for each of the 151 districts in the sample. There is heterogeneity within states in the discount across districts. For instance, in 2002, the discount in Assam varies from 15% to about 45% in the monsoon season, with a state level average of 38%. The average discount in Andhra Pradesh is 55% but the spread (47% to 65%) is much smaller as compared to Assam. A similar pattern of within state variation in the seasonal discount is seen for the other six years (panels B to G, Figures 2.2 and 2.3) .

Quotas

Different states set different quotas for rice and wheat ranging from 0 to 35 kg per household per month, as shown in Table 2.1. Some states do not index the quota to household size and for those that do, there is an upper limit on the maximum amount (except in West Bengal). Thus the per person quota varies by household, depending on its size and state of residence.[28]

[28] An examination of the average quantities bought via the PDS confirms that this variation is realized in practice (Appendix Table A).

Table 2.3 combines the two sources of variation and presents the spread of the per capita value of the subsidy for the sample under study. As expected, the spread of the per capita value (standard deviation) is the smallest in West Bengal and Andhra Pradesh, both of which index the subsidy to household size. The average subsidy in West Bengal is less than half of the subsidy in Andhra Pradesh. Overall, the value varies across seasons, states and within states.

2.4.3 Descriptive Statistics

Table 2.4 presents descriptive statistics for PDS users and the full NSSO sample averaged over all six years. The monthly per capita expenditure for PDS users is lower than that for the full sample, as expected. The average per capita caloric intake for PDS users is 2190 kcal. Given that over 78% of PDS users live in rural areas, this average is well below the minimum daily requirement (2100 kcal for urban and 2400 kcal for rural areas). PDS users spend a higher fraction of their total monthly expenditure (58%) on food. Scheduled Caste/Scheduled Tribe/Other Backward Castes comprise 76% of PDS users.

The PDS price is 50% lower than the market price. On average, each household buys more rice in the market than what they receive through the program – the PDS contributes 41% of the total rice consumed. Thus, the PDS is an important source, but not one that meets the entire food requirements of the household; almost three-fourths of the total food expenditure is on items other than rice.[29] Per capita cereal expenditure is a little over one fourth of food expenditure, but cereals contribute over 72% of the total calories consumed.

2.4.4 Empirical Specification and Assumptions

The basic equation to estimate the impact of the subsidy on household outcomes is

$$Y_{ijswt} = \alpha + \beta PerCapValSub_{ijswt} + \mathbf{X}_{ijswt}\gamma + \delta_j + \chi_w + \theta_{st} + \varepsilon_{ijswt} \quad (1)$$

Y_{ijswt} represents the outcome variable (such as per capita caloric intake) for household i in district j, state s, season w and year t. $PerCapValSub_{ijswt}$ is the per capita value of the subsidy to the household based on program rules and local prices. $\mathbf{X}_{ijswt}$ is a vector of household characteristics, δ_j and χ_w control for district-specific and seasonal effects respectively, and θ_{st} are state*year dummies. Standard errors are clustered at the district level, as all households in a district are subject to the same rules determining the per person monthly quota.

Household characteristics in $\mathbf{X}$ include education of the head of the household and the spouse, a quadratic in the age of the household head, the proportion of females in the household, land holdings (proxy for income) and urban location. Behrman and Deolalikar (1988) provide a comprehensive review of the literature on the demand

[29]The fact that households also purchase rice in the market suggests that resale of PDS rice through consumers is not a serious concern.

for nutrients in developing countries and find that education levels, size and demographic composition of the households are important determinants of the demand for calories.[30] While most studies on the PDS have focussed on the rural poor, the program is also critical in urban areas and the nutritional needs of households in the two areas are very different. District and seasonal dummies are included to take regional and climatic effects on the demand for calories into account. The model is saturated by introducing state*year dummies that control for any differences in state level effects and other assistance programs that BPL households in a particular state might be eligible for. With district, season and state*year controls, any variation in the price discount is due to unpredictable shocks to prices as a result of random weather phenomenon, arbitrary controls on the movement of goods and imperfectly integrated agricultural markets.

The parameter of interest from equation (1) is β, the coefficient on the value of the subsidy. The validity of the model rests on the assumption that after controlling for household characteristics and geographic and seasonal effects, the value of the subsidy (price discount* quota) is exogenous to unobservable factors that may affect the demand for food. If this assumption holds, the value of the subsidy should

[30] Though the dependent and main explanatory variable in equation (1) are both in per capita terms, there may still be economies of scale within a household that are not accounted for by this specification. I check for any effect of household size in the following ways. First, I use an alternative weighting scheme to generate per person variables for the household. Second, I use household level caloric intake and value of the subsidy to estimate the impact and explicitly control for family size. Third, I shut down the variation due to family size by using quotas based on the national average family size. Finally, even though household size as a regressor in equation (1) is potentially endogeneous, as an additional check, I find that adding size to the regression does not qualitatively change the results.

have a negative (through market price) or zero effect on the caloric consumption of households that do not use the program. To check for this, I perform a falsification test using non-PDS users.[31]

The analysis makes two other substantive assumptions. First, the model assumes that household size is exogenous to the state level quota, i.e. households do not adjust family size according to more or less generous program rules. While the program is important, it is not likely to affect the fertility or migration decisions of households. On average, the value of the subsidy is 4% of the total monthly expenditure of the household. I check for the validity of this assumption by using the national average family size instead of the actual size of the household to compute the value of the subsidy and find that the results remain qualitatively the same. I also check for the independent effect of family size by using total household caloric intake as the outcome and explicitly controlling for family size. Second, the analysis assumes that the demand for calories or rice by any one household does not affect the market price that it faces i.e. the local price in its district-season-year cell. In the absence of this assumption, the coefficients would suffer from simultaneity bias. Treating the household as a price taker is a standard assumption from the theory of competitive markets. The agricultural market in India has thousands of producers and consumers, which makes this assumption fairly reasonable in the context of this study.

[31] Tables 2.12-2.15 ahead present the results of multiple robustness checks.

2.5 Results

2.5.1 Impact on Cereal Consumption and Caloric Intake

To study the impact of the PDS on nutrition, three outcome variables are considered: per capita cereal consumption, per capita caloric intake and per capita calories from different food groups. Cereals are a cheap and critical source of calories and the PDS is responsible for providing a substantial amount of cereals to vulnerable households.[32] Column 1 of Table 2.5 presents results for the main specification with per capita cereal intake as the outcome variable. An increase in the monthly subsidy by Rs 10 leads to a 20.3 gm (60 kcal/day) increase in the daily consumption of cereals. Based on average market prices, Rs 10 (per month) can buy an extra 30.2 gm of cereals every day. This suggests that infra marginal households prefer to spend part of the extra income on foods other than cereals or on non-food items. The specification in column 1 assumes that an (absolute) increase in the value of the subsidy has the same effect, irrespective of the base value. Evaluated at the means, the estimate from column 1 implies an elasticity of 0.12, which is similar to the estimate from the log-log regression in column 2– 0.123. Given that the elasticity is small and the sample comprises only BPL households, it is not surprising that the estimates are so close.[33] Though small, the elasticity is positive and significant and

[32]Most cereals have 3-3.5 kcal/gm. See Appendix Table B for a comparison of the price per calorie for different food groups.

[33]The levels estimate assumes that the impact of an absolute increase in the value of the subsidy is independent of where in the distribution the household is located (linear relationship). In this sample, households are homogeneous to the extent that they all lie below the poverty line and receive a positive food subsidy. The log-log specification assumes a non-linear relationship and a constant elasticity. However, for an elasticity of 0.12, the resulting curve is very flat, i.e. almost linear, over the range of the value of the subsidy, cereal consumption and caloric intake.

confirms that the subsidy has a real impact on cereal consumption, as expected. In order to examine the impact of each of the components of the subsidy and determine their relative importance, column 3 splits the value of the subsidy into quota, prices and interaction terms. The coefficient on quota is insignificant, confirming that households are infra-marginal since the amount of the quota doesn't determine overall cereal consumption. The coefficient on market price is negative, as expected. The interaction between the amount of the quota and the market price is positive and significant, suggesting that a higher quota increases cereal consumption more, and is thus more valuable, when the market price of rice is higher.

Though the estimates suggest that the program has a positive effect on cereal consumption, households may be substituting some of the income gains away from cereals. Combining the analysis for calories with the results on cereals helps to determine the impact on overall food intake. Column 1 in Table 2.6 indicates that a Rs 10 increase in the value of the rice subsidy results in an increase an increase of 126 kcal/day.[34] This is more than double of the impact on calories through increased cereal consumption (60 kcal/day from by column 1 in Table 2.5), suggesting that the subsidy works by increasing calories through not just cereals, but other foods as well. This is an important indicator that households benefit from the program in terms of overall food intake and not just through the food grains directly provided

[34] In order to compare the estimates, I convert the gains in daily cereal consumption from Table 2.5 into caloric gains. The 95 % confidence interval from Table 2.5 implies an increase between 51 kcal/day and 69 kcal/day. This does not overlap with the confidence interval from Table 2.6 which is 104 kcal/day to 148 kcal/day. Thus, the overall gains in caloric intake are greater than the increase in calories from cereals alone.

by the PDS.

Table 2.6 also presents estimates of the cross food group elasticities.[35] In China, Jensen and Miller (2011) find negative effects of an experimental price subsidy for rice on the consumption of fruits and vegetables and pulses (lentils). In their study, they estimate the substitution effect (movement along the demand curve) of a food subsidy that changes the price of the staple food and find no evidence that the subsidy improved nutrition. Being a supplementary program, the PDS works through a different mechanism. The value of the PDS subsidy is essentially an income transfer as all households pay the market price for the marginal unit of food purchased. This implies a shift in the demand curve for food. I find that the effect of this shift is positive on all food groups.

2.5.2 Comparison with the Expenditure Elasticity of Calories

The PDS subsidy is supplementary in nature and thus is expected to operate through the income effect. The elasticity of calories with respect to the value of the subsidy is 0.144 from column 2 of Table 2.6. Though small, it lies between the historical estimates of income elasticity of calories for India, which range from 0 to 0.34. Behrman and Deolalikar (1990) find the income elasticity of calories for rural south India to be very low: 0.01. Subramanian and Deaton (1996) use NSSO data and report an expenditure elasticity of calories of 0.34 for rural households.

[35] For the sample in this paper: 5% of total calories come from lentils, 5% from fruits and vegetables and approximately 1% from meat, fish and other animal products.

To compare my results with these earlier studies, I estimate the elasticity of calories with respect to total expenditure for rural PDS households in my sample. The expenditure elasticity is close to the higher estimates in the previous literature: 0.4 from column 1 in Table 2.7. Even though the elasticity of caloric intake with respect to the subsidy is lower than the expenditure elasticity (0.140 for the rural sample), it is still positive and significant.[36]

The fact that the PDS acts like an income transfer raises the question of its impact on price paid per calorie i.e., the extent to which a rise in income induces households to sacrifice caloric intake for more expensive and less calorie rich foods. Behrman and Deolalikar (1989) suggest that the income elasticity of calories is smaller than the income elasticity of food expenditures because of changes in the shape of the food indifference curve as income rises. They find that even relatively poor households value variety. Subramanian and Deaton (1996) report the total expenditure elasticity of expenditure on food as 0.75 and the elasticity of price paid per (1000) calories as 0.35. These numbers are very close to the estimates for the sample used in this paper (columns 3 and 5 in Table 2.7). The elasticity of food expenditure with respect to the value of the subsidy is lower at 0.146, but it is positive and significant. The subsidy elasticity of price per calorie is not significantly different from zero. Thus the value of the subsidy is not large enough to raise concerns of

[36] It is not surprising that the elasticity of caloric intake with respect to the value of the subsidy is lower than the expenditure elasticity. This is true for two reasons: First, transaction costs associated with going to the fair price shop, such as irregular supply, inconvenient timings and long queues would make the impact of the subsidy smaller. A pure increase in income does not have any such costs associated with it. Second, this estimate takes into account leakages and inefficiencies in the system since it is based on actual program rules.

households sacrificing calories for taste.

One issue with the NSSO data (and any estimates based on them) is that they do not contain information on income. Table 2.8 presents alternate estimates of the elasticity of cereal consumption using income data from the India Human Development Survey 2005.[37] The survey is nationally representative, covers 41,554 households and collects detailed household information on demographics, income, debt, insurance and consumption. The income elasticity of cereals for PDS users is much lower (0.046 in column 1, panel A of Table 2.8) than the elasticity with respect to the rice subsidy which is 0.295 in column 2. The income elasticity of food expenditure is also much lower than the elasticity of food expenditure with respect to the value of the subsidy from columns 3 and 4 of panel A. While income is a reflection of more permanent characteristics of a household such as age and education of the head, location and occupation, the value of the subsidy fluctuates from month to month depending on market prices. Not all income is consumed, part of it saved or used to purchase durable goods, thus it is not surprising that an increase in the value of the subsidy has a bigger impact on cereal consumption than an increase in income. Further, income tends to be under-reported and the resulting measurement error would bias the estimates downwards.

The IHDS dataset allows me to check if the household characteristics used in the

[37]This survey is jointly conducted by National Council of Applied Economic Research in Delhi and the University of Maryland (Desai, Vanneman, & National Council of Applied Economic Research, 2005). I use the IHDS dataset to construct variables that are identical to variables from the NSSO data. I also restrict the sample to the eight rice favoring states used in the main analysis.

main regression are a valid control for income. Column 2 of panel A in Table 2.8 estimates the elasticity with respect to the value of the subsidy controlling for income, location, district and season effects. In column 3 of panel B, I run the same regression, but instead of explicitly including income, I add the education of the head of the household and the spouse, a quadratic in the age of the household head, the proportion of females in the household and land holdings. The estimates are similar, which validates the use of these characteristics in place of income.

The food module of the IHDS surveys is similar to the NSSO, but is much less detailed. To check for any effect of differences in survey methodologies, in panel B of Table 2.8, I estimate identical regressions for the IHDS and data from the NSSO covering the same time period (November 2004 - October 2005). The estimates for expenditure elasticity of cereals from the two datasets are similar: 0.247 and 0.269 in columns 1 and 2 of panel B.[38] The estimates of the elasticity of cereal consumption with respect to value of the subsidy across the two samples (panel B columns, 3 and 4) are also similar, though the IHDS estimate is slightly larger. The NSSO sample is larger than the IHDS, but the two don't differ on observable characteristics.[39] PDS prices are lower, and consequently the subsidy value is marginally higher on average (Rs 25.46) in the IHDS sample as compared to the NSSO data (Rs 24.17).[40] While

[38]The expenditure elasticity of cereal consumption (column 2 of panel B, Table 2.8) is lower than the expenditure elasticity of calories (column 1, Table 2.7). Deaton and Drèze (2009) find a similar pattern and attribute it to the fact that a higher fraction of the marginal rupee spent on food goes towards non-cereal food items.

[39]Appendix Table D presents descriptive statistics for the two samples.

[40]Price data in the IHDS is collected directly, by asking households for their estimate of the average market price of various goods over the last 30 days.

it is difficult to say with certainty why the estimates differ, the IHDS results do not qualitatively change the implications of the main analysis. At best, they suggest that the estimates from the NSSO data may be a lower bound on the impact of the program.

2.5.3 Heterogeneous Impacts

Households that benefit from the PDS are similar to the extent that they all lie below the poverty line. However, the program could have differential impacts on certain sub-groups of the population. Table 2.9 checks for heterogenous impacts of the subsidy on urban households, traditionally marginalized communities, farming households and households in the lowest expenditure quartile. While urban households face different patterns of price changes compared to rural ones and may have different mechanisms to cope with food insecurity, (rice) farming households may be more or less affected by market prices depending on whether they are net buyers or sellers in the market. Traditionally marginalized communities may face discrimination in terms of access to the program and households in the lowest expenditure quartile may lack sufficient income to fully leverage the subsidy provided through the program. Residing in an urban area has a negative and significant impact on cereal consumption (column 1). This is expected as urban calorie requirements are lower on average. However, the program does not have a significantly different impact in urban areas. Columns 2 and 3 check for the impact on cereal consumption of traditionally marginalized communities (by caste) and the poorest quartile of the sample, respectively. There is no significantly different impact for the SC/ST/OBC category. Households in the lowest expenditure quartile consume fewer cereals, but the subsidy does not have a differential impact on them.

The program has a strong, positive effect on the cereal consumption and caloric intake of farmers, i.e. households that report consuming some of their home grown rice (columns 4 and 8). Given that these households need to rely less on the market and are not likely to make cereal purchases, the subsidy acts like a direct in-kind transfer of extra grains. As there is no income gain, these household can not substitute cereals with other types of food or other goods. For the sample of farmers, Table 2.10 splits the subsidy into its components and confirms that market price is not a significant determinant of caloric intake (column 2) and marginally significant for cereal consumption (column 1). This is in contrast to results for the overall sample (column 3 of Table 2.5) where market price was seen to have a significant and negative impact. The interaction between market price and per capita quota has the expected positive sign and is significant.

From column 7 of Table 2.9, the impact of the subsidy on the caloric intake of the lowest income quartile is significantly lower, compared to other households. This group represents the poorest of the poor. For an increase in the value of the subsidy, these households appear to substitute away from food towards other non food items. Table 2.11 presents elasticities of cereal consumption and caloric intake for the four income quartiles of PDS users. The elasticities increase with income, suggesting that the poorest households (also likely to be the most credit constrained) use the extra income generated by the subsidy to purchase non food items.[41] This is consistent with the hypothesis in Sen (2005) that an increase in the availability, demand and prices of non-food essential goods and services has resulted in squeezing of the food budget of poor families.

2.5.4 Robustness and Sensitivity Checks

The identification strategy rests on the assumption that there are no underlying factors that simultaneously affect the value of the subsidy and food consumption of households. To test the validity of this assumption, I perform a falsification test by checking for the impact of the local average value of the PDS subsidy on the cereal consumption and caloric intake of households that do not receive subsidies from the PDS. From Table 2.12, it is clear that the program has no impact on the consumption of Non-PDS beneficiaries. The only (marginally) significant effect is the elasticity of cereal consumption. As expected, this is negative since a higher value of the subsidy (resulting from a higher market price of rice) would negatively affect cereal consumption of households that purchase cereals only in the market.

Table 2.13 presents results from a series of robustness checks. Concerns about the possible endogeneity of household size are addressed in columns 1 and 2. In column 1, the national average family size is used to calculate the value of the subsidy

[41] There is no difference in terms of quantity of rice purchased from the PDS across expenditure quartiles, implying that even households in the lowest quartile purchase the full PDS entitlement and the lower impact on their cereal consumption is not driven by an inability to fully avail of the PDS discount.

instead of the actual size and composition of each household. Column 2 presents the elasticity results at the household level, with a control for household size. The estimates from both are very close to the main result (0.144) which supports the assumption that household size is not influenced by the program. To check that the results are not driven by the equivalence scale used in the main analysis, column 3 uses a simple per capita estimate. The results remain qualitatively similar to those from the main analysis, though using a simple per capita without correcting for the composition of the household makes the elasticity appear larger. Averaging across the market price of rice within a district-season-year cell should not raise concerns of significant differences in quality, since households in the sample all lie below the poverty line. However, I check for this possibility by using the median prices to calculate the value of the subsidy and find that the results remain the same (column 4). Finally, I check the sensitivity of my results to seasonal price patterns by utilizing survey waves/sub-rounds. Replacing state*year and season dummies with state*survey wave dummies does not change the estimates, as seen in column 5.

Table 2.14 checks for the impact of the rice subsidy on three different samples – All India, the rice favoring states and non-rice favoring states. As expected, the elasticity is much smaller in states where rice is not the main staple, even though some of them offer a small subsidy on rice. This justifies using the smaller sample of rice favoring states to get a more valid estimate of the impact of the rice subsidy program. Conversely, Table 2.15 checks for the impact of the (much smaller) wheat subsidy in the main sample of rice favoring states. The effect of the wheat subsidy on both cereal consumption and caloric intake is extremely small and its inclusion makes the effect of the rice subsidy a bit larger. To the extent that the value of the subsidy is higher when the market price of rice (and possibly other goods) is higher, this is expected because the wheat subsidy provides a control for the overall level of market prices.

2.5.5 Issues in Implementation and Policy Changes

2.5.5.1 Corruption

The PDS has been criticized for various types of inefficiencies and corruption and there are striking state-wise differences in implementation. Khera (2011a) estimates the extent of diversion in food grains using a combination of NSSO data and administrative records on grain allocation at the state level. She categorizes states into those that are performing (well) and others that are reforming or languishing.[42] Table 2.16 presents results for the impact on cereal consumption and caloric intake. Columns 1 and 2 suggest that the impact on cereals and caloric intake is almost 50% lower in states that are more corrupt.[43] This is a huge cost of inefficiency and is particularly troubling given the high levels of malnutrition that persist in India.

[42] Of the eight states in the sample, three are categorized as functioning well: Andhra Pradesh, Karnataka and Kerala.

[43] These estimates provide suggestive, not causal evidence of the effect of corruption as there could be many other state level factors that make the program less (more) effective in more (less) corrupt states.

2.5.5.2 The National Food Security Bill

The PDS is the government's flagship program for improving nutritional outcomes and the National Food Security Bill (NFSB), passed in September 2013, plans to expand it further. Unless the enormous leakages in the system are plugged, the government will have to procure a much higher quantity of food grains (than the target) in order to have the intended effect on nutritional outcomes. A rough estimate of the impact of the NFSB can be made using price data, program rules and the elasticity estimates from this paper. The NFSB assures 5 kg of food grains per person per month to 67 % of the population at Rs 3 per kg for rice, Rs 2 per kg for wheat and Re 1 per kg for coarse grains. BPL households are currently eligible for an average of 4 to 5 kg per person per month.[44] At current prices, it is estimated that the per kilogram subsidy will rise from Rs 13.5 to Rs 16.5 (The Financial Express, September 2013). Thus the NFSB does not substantially increase the quantity of food grains assured to BPL households, but it does entail a big increase in the price discount they receive. Combined with average caloric intake and current price data, the elasticity estimate from this paper suggests that the bill will lead to a per person increase of 72 kcal/day in rural areas and 66 kcal/day in urban areas for the current beneficiaries of the program.[45] This estimate is based on program rules and thus takes into account the leakages and inefficiencies in the system. If the expansion

[44] Many state governments such as Tamil Nadu, Andhra Pradesh and Chattisgarh already have a more generous PDS than the national average and provide food grains to a large fraction of their population at these low prices. Further, Antyodaya households are eligible for 35 kg per month at even lower prices.

[45] This estimate uses the approximate caloric intake of PDS rice users in rural (2260.25 kcal/day) and urban areas (2076.5 kcal/day) from the 2009-10 round of the NSSO Surveys (Government of India, 2013).

of the PDS is accompanied by better enforcement, especially in the more corrupt states, the impact will be even higher.

The bill will also expand the beneficiary pool of the PDS to include 67% of the population.[46] While it is difficult to precisely predict how newly eligible households will respond to the subsidy, there is some evidence to suggest that there will be a positive effect (similar to that for current beneficiaries) on their caloric intake. Given that the new beneficiaries are likely to be better off, the subsidy will not be their primary source of food grains and thus, should have a positive effect on caloric intake through the standard income effect. This hypothesis is supported by the results in Table 2.11, which show that the elasticity of caloric intake is higher for households in the higher expenditure quartiles. There is a concern that expansion in the reach of the program could result in the inclusion of some households that have an income high enough to make the relative value of the subsidy too insubstantial to have an effect. These households are also likely to have have lower rates of participation, which would further reduce the overall impact of the program on caloric intake. Neither of these concerns is found to relevant in Tamil Nadu, which is the only state in India that has a universal PDS. The participation rate for the entire population of the state (averaged over the six years) is high (61%) and the elasticity of caloric intake with respect to the value of the subsidy is 0.2, which is higher than the national average (0.144). Tamil Nadu has a well functioning PDS and the data from this state suggest that if implemented well, the program can have

[46] 44.5% of the population currently participates in the PDS (The Indian Express, July 2013).

a substantial impact on caloric intake for a wide range of households.

2.6 Conclusion

This paper examines the Indian Public Distribution System and presents evidence of its impact on nutrition using variation in state specific program rules and fluctuations in local market prices. In agreement with the literature on food subsidies, the elasticities for cereal consumption and calories with respect to the value of the subsidy are small. However the results indicate that households benefit from the program in terms of food intake (calories) and not this is not just through the food grains (cereals) directly provided by the PDS. Even though the program provides a subsidy only on cereals, it has a positive effect on the consumption of different food groups. Thus, the PDS subsidy generates an income effect for households and is effective in improving nutrition. The results also confirm state wise differences in the functioning and impact of the PDS. Finally, the elasticity estimates suggest that the implementation of the National Food Security Bill will lead to an increase of 66 - 72 kcal in the daily caloric intake of current beneficiaries of the program.

Some states and regions in India have had much more success in implementing the PDS than others. The Indian Human Development Survey is a rich socio-economic dataset that makes it possible to study these regional differences in more detail. In additional to details on household expenditure, income and fertility, indicators for learning skills and anthropometrics for children are also collected. Examining district level outcomes using participation and average value of the subsidy would be an additional dimension to studying the PDS. This would speak to the significant geographic differences that have been noted in the functioning of the system. Another unexplored aspect of the PDS is the protection it provides from fluctuations in market prices. This would be an interesting angle to assess its value as a source of food security. Reduced exposure to market risk could also affect a households investments and labour market choices.

The PDS has been the topic of a lot of debate recently. The National Food Security Bill, which was passed in September 2013, will give two thirds of the population the legal right to obtain 5 kg of food grains (per person per month) at prices between Re 1 and Rs 3 per kg The bill also has implications for intra-household bargaining, since it makes the eldest woman in the household responsible for accessing the PDS on behalf of her family. Given the enormous scale of the PDS, its expansion and imminent overhaul, it is important to study the impact that it has in its present form.

Figure 2.1: Impact of a food subsidy on the budget set

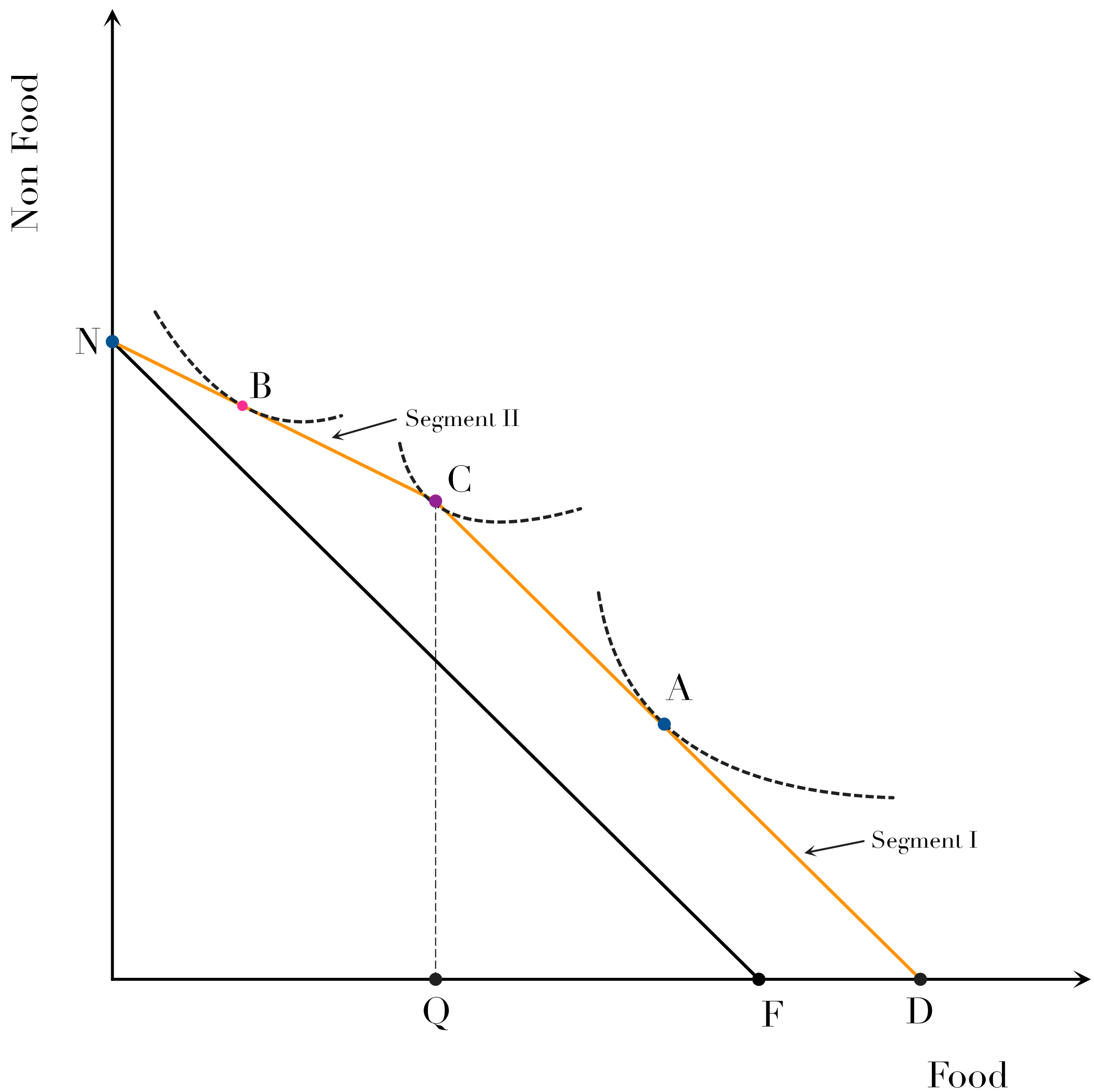
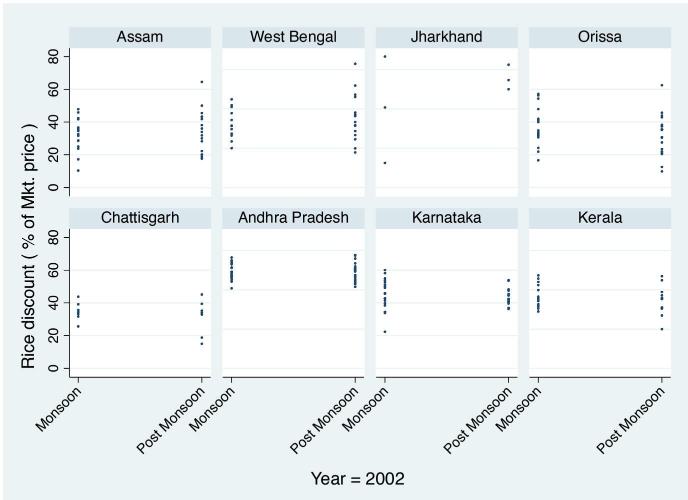
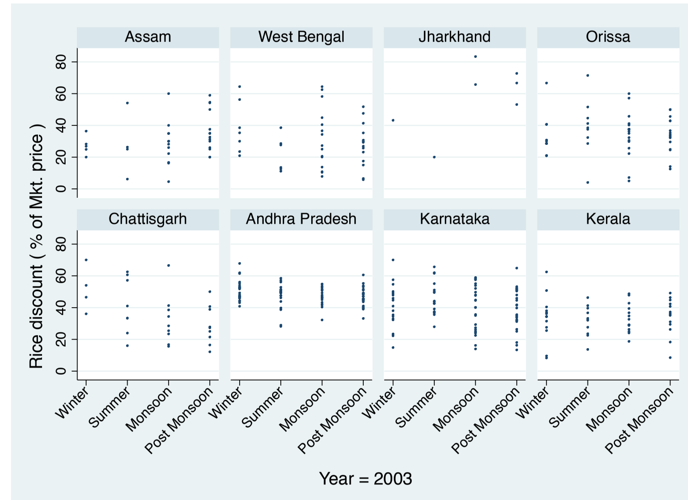


Figure 2.2: Variation in PDS Rice discount (2002-2008)

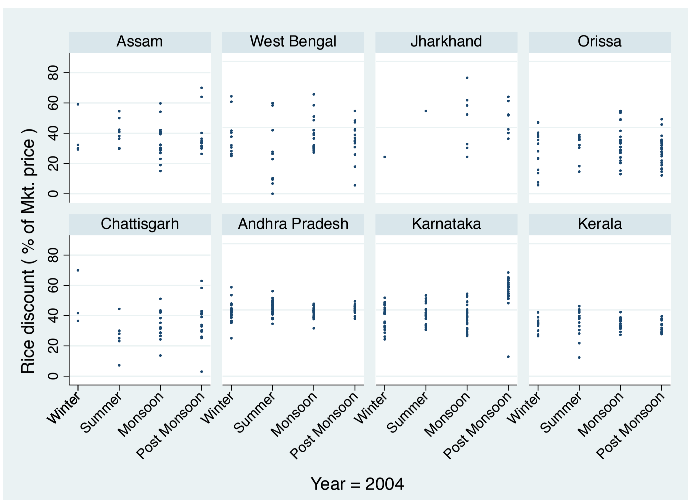
Panel A



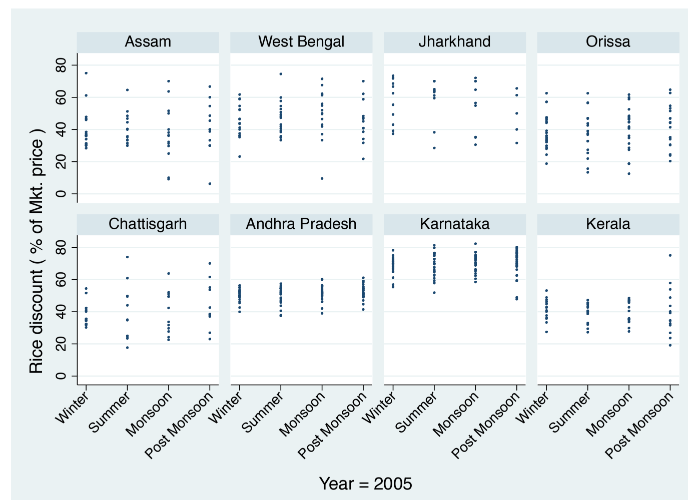
Panel B



Panel C



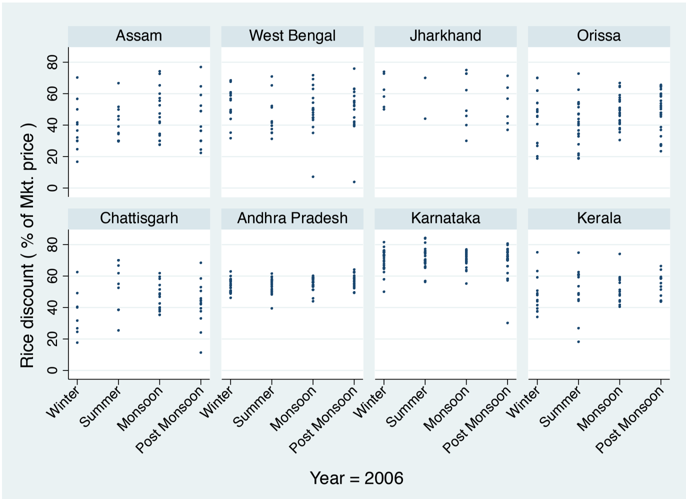
Panel D



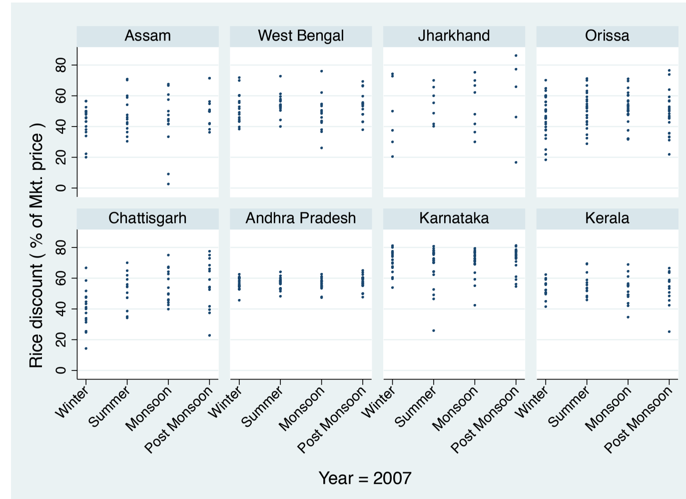
Notes: 1. Round 58 surveyed households between July and December 2002, resulting in no observations from the winter and summer season for this year. 2. Discount calculated as (Mkt. price - PDS price)/Mkt. price*100 3. Averages based on PDS and market prices reported by PDS users in the sample.

Figure 2.3: Variation in PDS Rice discount (2002-2008) (continued)

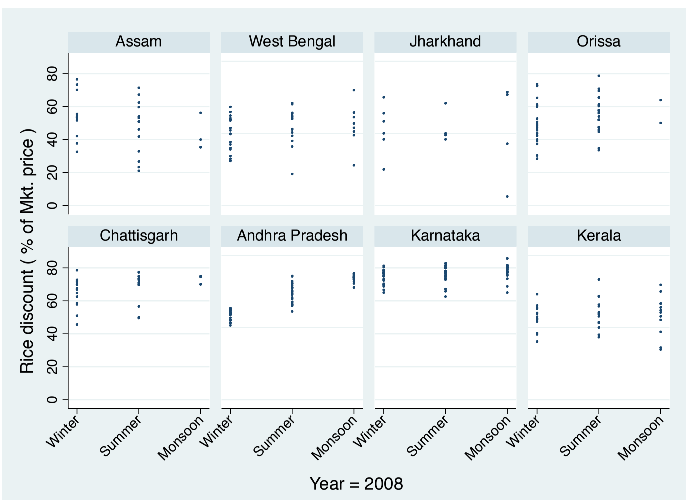
Panel E



Panel F



Panel G



Notes: 1. Round 63 surveyed households between January and June 2008, resulting in no observations from the post monsoon season for this year. 2. Discount calculated as (Mkt. price - PDS price)/Mkt. price*100 3. Averages based on PDS and market prices reported by PDS users in the sample.

Table 2.1: State specific PDS quotas for BPL households

State	Rice (kg)	Wheat (kg)
Andhra Pradesh	4 per person (20 hh max)	5 (at APL price*)
Assam	20	0
Bihar	15	15
Chattisgarh	25	0
Gujarat	1 per person (3.5 hh max)	1.5 per person (9 hh max)
Haryana	10	25
Himachal Pradesh	15	20
Jharkhand	35	0
Karnataka	16	4
Kerala	8 per adult 4 per child (20 hh max)	5 (at APL price*)
Madhya Pradesh	6	17
Maharashtra	5	15
Meghalaya	2 per person	0
Orissa	16	0
Punjab	10	25
Rajasthan	5	25
Uttar Pradesh	20	15
West Bengal	2 per person	2 per person

Sources: Planning Commission (2005), Khera (2011b) and *Simplifying the food security bill* at $http://bit.ly/PM_NFSB$. Notes: 1. * denotes all households pay Above Poverty Line prices i.e. no price discount. 2. PDS entitlements are for the period under study: 2002-2008. 3. Tamil Nadu is excluded as it follows a universal PDS.

Table 2.2: Variation in PDS Rice discount (%)

	Winter (January-March)						**Summer (April-May)**					
State	Mean	Std. Dev	p10	p50	p90	N	Mean	Std. Dev	p10	p50	p90	N
Assam	41.46	10.59	20	40.04	56.45	233	41.78	11.11	6.17	41.82	54.17	163
West Bengal	47.79	10	23.51	47.94	60.32	445	48.56	11.28	11.12	50.77	61.18	320
Jharkhand	54.75	13.57	20.45	51.52	72.73	73	56.62	11.6	20	62.86	70	68
Orissa	42.88	11.76	18.33	44.12	59.42	544	44.58	12.01	13.33	44.57	57.92	427
Chattisgarh	45.15	13.83	17.65	41.04	67.09	265	49.14	17.95	16	49.53	73.33	178
Andhra Pradesh	53.36	5.52	39.91	53.52	60.24	2952	56.13	9.96	37.39	54.53	72.83	2134
Karnataka	66.92	11.6	23.39	69.82	77.32	1239	66.86	11.63	35.56	69.67	78.18	791
Kerala	45.16	10.17	27.39	42.8	59.89	970	47.03	12.42	18.18	45.82	63.74	620
	Monsoon (June-September)						**Post Monsoon (October-December)**					
State	Mean	Std. Dev	p10	p50	p90	N	Mean	Std. Dev	p10	p50	p90	N
Assam	38.1	13.92	4.55	35.48	60	283	39.44	13.41	17.65	36.93	59.13	230
West Bengal	43.29	11.9	7.82	43.56	57.19	618	43.35	12.77	6.41	43.13	58.5	531
Jharkhand	52.73	17.17	6.25	54.83	75	76	54.47	14.22	16.67	54.69	71.33	52
Orissa	40.63	10.11	16.59	40.42	53.48	693	40.3	10.9	16.67	39	55.48	623
Chattisgarh	42.48	12.94	22.5	41.98	63.69	398	41.21	13.67	11.33	39.48	58.43	324
Andhra Pradesh	52.94	8.01	36.13	53.05	58.99	3952	52.4	5.53	40.98	52.15	60.23	3307
Karnataka	58.22	15.45	24.38	62.13	75.07	1697	60.2	15.04	14.67	65.5	75	1335
Kerala	42.77	10.55	18.7	42.32	58.22	1452	41.65	10.71	18.26	39.27	58.66	1217

Source: Calculations using 2002-2008 NSSO Socio-Economic Surveys.

Notes: 1. Discount calculated as (Mkt. price - PDS price)/Mkt. price*100 2. Averages based on PDS and market prices reported by PDS users in the sample.

Table 2.3: Variation in the per capita value of the PDS Rice Subsidy (Rs)

	Winter (January-March)						Summer (April-May)					
State	Mean	Std. Dev	p10	p50	p90	N	Mean	Std. Dev	p10	p50	p90	N
Assam	23.52	11.11	8.64	20.94	38.67	233	26.56	14.4	3.86	23.47	43.42	163
West Bengal	11.44	3.27	4.62	11.01	16.13	445	11.9	3.37	2.21	12	15.63	320
Jharkhand	52.11	29.69	14.35	44.38	84	73	60.51	38.41	15.12	53.2	98	68
Orissa	18.89	12.55	4.14	15.98	31.97	544	18.95	11.43	4	16.48	29.99	427
Chattisgarh	33.15	27.58	8.28	25.55	52.71	265	35.66	29.53	5.19	29.39	61.99	178
Andhra Pradesh	25.36	6.23	12.21	25.18	33.44	2952	26.95	7.81	11.94	25.96	36.35	2134
Karnataka	35.89	21.56	6.93	31.74	58.24	1239	37.93	25.26	8.32	31.49	63.76	791
Kerala	31.11	14.14	7.27	29.72	49.81	970	33.07	15.31	7.8	29.86	53.1	620
	Monsoon (June-September)						**Post Monsoon (October-December)**					
State	Mean	Std. Dev	p10	p50	p90	N	Mean	Std. Dev	p10	p50	p90	N
Assam	24.38	13.98	2.7	22	41.81	283	26.12	18.65	7.2	21.89	41.63	230
West Bengal	10.76	3.55	2	10.55	14.74	618	10.88	3.83	1.52	10.69	15.61	531
Jharkhand	45.45	29.08	7.17	38.04	77	76	54.03	31.11	7.7	45.53	79.8	52
Orissa	17.07	9.69	4.34	15.18	28	693	17.94	11.33	4.85	14.87	28.8	623
Chattisgarh	32.51	23.28	7.02	24.72	59.79	398	31.2	26.64	3.73	24.55	54.93	324
Andhra Pradesh	25.87	6.99	12.09	25.27	34.72	3952	26.1	6.55	12.43	25.6	34.94	3307
Karnataka	32.62	20.37	6.63	28.71	55.37	1697	33.71	21.71	4.79	29.1	56.25	1335
Kerala	29.89	13.48	7.7	28.28	48.89	1452	29.12	12.81	6.34	27.64	46.27	1217

Source: Calculations using 2002-2008 NSSO Socio-Economic Surveys.

Notes: 1. Value of the subsidy calculated as Per capita Quota*(Mkt. price - PDS price) 2. Averages based on PDS and market prices reported by PDS users in the sample.

Table 2.4: Descriptive statistics for the full sample and PDS users

Sample:	Full Sample		PDS users	
	Mean	Standard deviation	Mean	Standard deviation
Monthly expenditure per capita (Rs)	1011.0	(1085.3)	636.8	(393.4)
Daily calories per capita (kcal)	2334.2	(1300.9)	2190.9	(623.7)
Proportion spent on food	0.547	(0.142)	0.577	(0.116)
Size of the household	4.570	(2.382)	4.736	(1.891)
Number of children below 15	1.411	(1.428)	1.538	(1.339)
Proportion of women	0.515	(0.207)	0.512	(0.152)
Age of household head	46.58	(13.61)	45.38	(12.17)
Urban dummy	0.363	(0.481)	0.219	(0.414)
Electricity	0.724	(0.447)	0.725	(0.446)
Permanent home	0.338	(0.473)	0.314	(0.464)
SC/ST/OBC	0.592	(0.491)	0.765	(0.424)
PDS rice price (Rs/kg)			5.271	(1.855)
Mkt rice price (Rs/kg)			10.80	(2.193)
PDS rice qty (kg)			18.64	(9.392)
Market rice qty (kg)			26.11	(20.24)
Food expenditure per capita (Rs)			400.5	(168.9)
Cereal expenditure per capita (Rs)			116.0	(43.85)
Rice subsidy per capita (Rs)			25.71	(11.90)
Rice proportion of food expenditure			0.260	(0.130)
Proportion of calories from rice			0.615	(0.175)
Proportion of calories from cereals			0.727	(0.0987)
Observations	124228		22564	

Notes: 1. Rural Poverty line is Rs 497.6, Urban Poverty line is Rs 635.7 (Planning Commission, Government of India). 2. Average daily minimum calorie requirements are 2400 kcal for rural and 2100 kcal for urban areas. 3. All prices in 2005 Rupees. (Rs 45.3 = 1 USD in 2005). 4. The category cereals includes rice, wheat, semolina, jowar, bajra, millets, corn, barley and ragi. 5. The sample comprises households in the following states: Andhra Pradesh, Assam, Karnataka, Kerala, Orissa, Jharkhand, Chattisgarh and West Bengal.

Table 2.5: Impact of the subsidy on cereal consumption

Dependent variable:	Cereal consumption (1)	Log cereal consumption (2)	Cereal consumption (3)
Rice subsidy per capita	2.030***		
	(0.158)		
Log rice subsidy per capita		0.123***	
		(0.00963)	
Rice quota per capita			-1.968
			(4.442)
Market price* quota per capita			1.697***
			(0.436)
PDS price* quota per capita			0.157
			(0.463)
PDS price			-1.607
			(2.849)
Market price			-6.131**
			(2.395)
Observations	22564	22564	22564
Adjusted R^2	0.250	0.270	0.258

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. Dependent variable in columns (1) and (3) is daily cereal consumption per capita (grams), dependent variable in column (2) is log of daily cereal consumption per capita.

Table 2.6: Impact of the subsidy on calories from different foodgroups

Dependent variable:	Caloric intake	Log caloric intake	Log caloric intake from food group			
			Cereals	Lentils	Fruits & Vegetables	Meat
	(1)	(2)	(3)	(4)	(5)	(6)
Rice subsidy per capita	12.58***					
	(1.116)					
Log rice subsidy per capita		0.144***	0.123***	0.154***	0.234***	0.170***
		(0.0103)	(0.00963)	(0.0177)	(0.0160)	(0.0187)
Observations	22564	22564	22564	22118	22562	19833
Adjusted R^2	0.124	0.166	0.270	0.215	0.441	0.426

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females land owned) and urban, state*year, district and season dummies. 3. Dependent variable in column (1) is daily caloric intake per capita (kcal), dependent variable in column (2) is log of daily caloric intake per capita, dependent variable in column (3) is log of calories from cereals per capita, dependent variable in column (4) is log of calories from lentils per capita, dependent variable in column (5) is log of calories from fruits and vegetables per capita, and dependent variable in column (6) is log of calories from meat per capita.

Table 2.7: Expenditure elasticity of calories and food expenditure: Rural sample

Dependent variable:	Log caloric intake		Log food expenditure		Log Rupees per calorie	
	(1)	(2)	(3)	(4)	(5)	(6)
Log monthly expenditure per capita	0.406***		0.751***		0.345***	
	(0.0103)		(0.00883)		(0.0102)	
Log rice subsidy per capita		0.140***		0.146***		0.00575
		(0.0135)		(0.0153)		(0.00632)
Observations	13333	13333	13333	13333	13333	13333
Adjusted R^2	0.437	0.157	0.820	0.404	0.675	0.527

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and state*year, district and season dummies. 3. Dependent variable in columns (1) and (2) is log of daily caloric intake per capita, dependent variable in columns (3) and (4) is log of food expenditure per capita, dependent variable in columns (5) and (6) is log of price paid per 1000 calories. 5. As in Subramanian and Deaton (1996), the sample comprises only rural households and monthly expenditure is calculated net of purchases of durable goods.

Table 2.8: Income elasticity of cereal and food consumption

Panel A: IHDS data				
Dependent variable:	Log cereal consumption		Log food expenditure	
	(1)	(2)	(3)	(4)
Log monthly income per capita	0.0462***	0.0304***	0.0966***	0.0827***
	(0.00972)	(0.00959)	(0.0108)	(0.0105)
Log rice subsidy per capita		0.295***		0.259***
		(0.0323)		(0.0323)
Observations	3962	3962	3962	3962
Adjusted R^2	0.306	0.354	0.402	0.429

Panel B: IHDS and NSSO data				
Dependent variable:	Log cereal consumption			
Data:	IHDS	NSSO	IHDS	NSSO
Log monthly expenditure per capita	0.247***	0.269***		
	(0.0178)	(0.0264)		
Log rice subsidy per capita			0.320***	0.179***
			(0.0314)	(0.0390)
Observations	3962	4255	3962	4255
Adjusted R^2	0.388	0.357	0.358	0.286

Standard errors in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations in panel A include urban, district and season dummies. All equations in panel B include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, district and season dummies. 3. Dependent variable in columns (1) and (2) of panel A and columns (1)-(4) of panel B is log of cereal consumption per capita, dependent variable in columns (3) and (4) of panel A is log of food expenditure per capita. 4. The data come from the India Human Development Survey 2004-05 and the NSSO surveys covering November 2004 - October 2005.

Table 2.9: Impact of the subsidy on cereal consumption and caloric intake: Heterogeneity by social group

Dependent variable:	Cereal consumption per capita				Caloric intake per capita			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rice subsidy per capita	1.979***	1.892***	1.830***	1.960***	12.41***	11.61***	11.55***	12.28***
	(0.172)	(0.209)	(0.173)	(0.159)	(1.214)	(1.046)	(1.309)	(1.142)
Urban dummy	-31.61***	-24.97***	-30.90***	-24.86***	-82.32***	-63.93***	-104.0***	-59.30***
	(6.412)	(3.026)	(3.084)	(3.030)	(27.98)	(13.92)	(13.52)	(13.91)
Urban*Rice subsidy	0.240				0.772			
	(0.241)				(1.054)			
SC/ST/OBC		1.488				-76.34***		
		(5.767)				(27.20)		
SC/ST/OBC*Rice subsidy		0.186				1.242		
		(0.205)				(1.001)		
Lowest expenditure quartile			-52.27***				-334.8***	
			(6.058)				(29.14)	
Lowest quartile*Rice subsidy			-0.106				-2.961**	
			(0.205)				(1.169)	
Home grown rice				-15.73*				-41.21
				(8.247)				(39.68)
Home grown*Rice subsidy				1.300***				5.893***
				(0.328)				(1.609)
Observations	22564	22564	22564	22564	22564	22564	22564	22564
Adjusted R^2	0.250	0.250	0.274	0.251	0.124	0.124	0.183	0.126

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. Dependent variable in columns (1)-(4) is daily cereal consumption per capita (grams), dependent variable in columns (5)-(8) is daily caloric intake per capita (kcal).

Table 2.10: Impact of the subsidy on rice producing households

Dependent variable:	Cereal consumption	Caloric intake
	(1)	(2)
Rice quota per capita	-14.15	-38.18
	(18.56)	(84.41)
Market price* quota per capita	4.483**	19.52**
	(1.792)	(7.896)
PDS price* quota per capita	-0.989	-5.916
	(1.976)	(8.667)
PDS price	3.226	38.62
	(10.98)	(49.72)
Market price	-17.15*	-52.60
	(8.760)	(40.03)
Observations	2111	2111
Adjusted R^2	0.231	0.241

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. The equation present results clustered at the district level. 2. The equation includes household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. Dependent variable in column (1) is daily cereal consumption per capita (grams), dependent variable in column (2) is daily caloric intake per capita (kcal). 4. The sample comprises PDS households that report own (produced) rice as one of their sources of supplementary grains.

Table 2.11: Elasticity of cereal consumption and caloric intake by expenditure quartile

Panel A: Cereal consumption

Dependent variable:	Log cereal consumption per capita			
Expenditure quartile:	Lowest			Highest
	(1)	(2)	(3)	(4)
Log rice subsidy per capita	0.0689***	0.0895***	0.109***	0.175***
	(0.0138)	(0.0147)	(0.0137)	(0.0180)
Observations	5677	5709	5696	5482
Adjusted R^2	0.320	0.362	0.330	0.272

Panel B: Caloric intake

Dependent variable:	Log caloric intake per capita			
Expenditure quartile:	Lowest			Highest
Log rice subsidy per capita	0.0682***	0.0933***	0.111***	0.196***
	(0.0135)	(0.0132)	(0.0129)	(0.0182)
Observations	5677	5709	5696	5482
Adjusted R^2	0.251	0.294	0.279	0.177

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. In going from columns (1) to (4), the sample comprises households in the lowest, second lowest, second highest and highest expenditure quartile of PDS rice users, respectively. 4. Dependent variable in panel A is log of cereal consumption per capita, dependent variable in panel B is log of daily caloric intake per capita.

Table 2.12: Impact on Non-PDS users

Dependent variable:	Cereal cons. (1)	Log cereal cons. (2)	Caloric intake (3)	Log caloric intake (4)
Rice subsidy per capita	-0.0706		0.462	
	(0.115)		(0.772)	
Log rice subsidy per capita		-0.0141*		-0.00863
		(0.00750)		(0.00686)
Observations	26494	26494	26494	26494
Adjusted R^2	0.256	0.261	0.045	0.152

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. Dependent variable in column (1) is daily cereal consumption per capita (grams), dependent variable in column (2) is log of daily cereal consumption per capita, dependent variable in column (3) is daily caloric intake per capita (kcal), dependent variable in column (4) is log of daily caloric intake per capita.
4. The sample comprises households that do not receive any subsidies from the PDS. They are assigned their respective local average value of the PDS subsidy.

Table 2.13: Alternative specifications for value of the subsidy

Dependent variable:	Log caloric intake				
	(1)	(2)	(3)	(4)	(5)
Log rice subsidy (avg. family size)	0.134***				
	(0.00763)				
Log rice subsidy (household level)		0.131***			
		(0.0147)			
Size of the household		0.134***			
		(0.00243)			
Log rice subsidy (per person)			0.202***		
			(0.00992)		
Log rice subsidy (median prices)				0.119***	
				(0.0103)	
Log rice subsidy per capita					0.148***
(state*survey wave)					(0.0107)
Observations	22564	22564	22564	22543	22564
Adjusted R^2	0.173	0.613	0.200	0.159	0.168

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females land owned) and urban and district dummies. Equations (1)-(4) include state*year and season dummies. Equation (5) includes state*survey-wave dummies. 3. Dependent variable in columns (1), (4) and (5) is log of daily caloric intake per capita, dependent variable in column (2) is log of daily caloric intake at the household level, dependent variable in column (3) is log of daily caloric intake at the household level divided by the total number of household members.

Table 2.14: Impact on different sub-samples of states

Dependent variable:	Log cereal consumption			Log caloric intake		
States:	All	Rice	Non Rice	All	Rice	Non Rice
	(1)	(2)	(3)	(4)	(5)	(6)
Log rice subsidy per capita	0.0796***	0.123***	0.0439***	0.101***	0.144***	0.0666***
	(0.00677)	(0.00963)	(0.00664)	(0.00701)	(0.0103)	(0.00675)
Observations	33231	22564	10667	33231	22564	10667
Adjusted R^2	0.263	0.270	0.255	0.197	0.166	0.255

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. Dependent variable in columns (1) - (3) is log of daily cereal consumption per capita, dependent variable in columns (4)-(6) is log of daily caloric intake per capita. 4. The rice favoring states are: Andhra Pradesh, Assam, Chattisgarh, Jharkhand, Karnataka, Kerela, Orissa and West Bengal. The non-rice favoring states are: Bihar, Gujarat, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Punjab, Rajasthan and Uttar Pradesh.

Table 2.15: Impact of the wheat subsidy

Dependent variable:	Log cereal consumption	Log caloric intake
	(1)	(2)
Log rice subsidy per capita	0.138***	0.156***
	(0.0110)	(0.0125)
Log wheat subsidy per capita	0.0172***	0.0270***
	(0.00549)	(0.00519)
Observations	12235	12235
Adjusted R^2	0.275	0.193

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level. 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, state*year, district and season dummies. 3. Dependent variable in column (1) is log of daily cereal consumption per capita, dependent variable in column is log of daily caloric intake per capita.

Table 2.16: Impact of the subsidy on cereal consumption and caloric intake: State level functioning

Dependent variable:	Cereal consumption per capita (1)	Caloric intake per capita (2)
Rice subsidy per capita	2.359***	12.04***
	(0.180)	(1.148)
Corrupt*Rice subsidy	-1.207***	-7.060***
	(0.304)	(1.480)
Observations	22564	22564
Adjusted R^2	0.251	0.117

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All equations present results clustered at the district level 2. All equations include household characteristics (education of household head and spouse, age and age squared of household head, proportion of females, land owned) and urban, state-year, district and season dummies. 3. Dependent variable in column (1) is daily cereal consumption per capita (grams), dependent variable in column (2) is daily caloric intake per capita (kcal).

Chapter 3: Intra-Household Allocation of Educational Expenses: Gender Discrimination versus Investment for the Future

3.1 Introduction

Discrimination against women, and in particular daughters, exists in many parts of the developing world. This is especially true in India, where a strong preference for sons has resulted in a skewed sex ratio due to female infanticide, sex selective abortions (Arnold, Kishor and Roy 2002), and the lack of proper diet and medical care for girls (Dasgupta 1987). Amartya Sen (1990) notes that North Africa, China and South Asia have such severely skewed sex ratios that over a 100 million women are 'missing' due to various forms of neglect.

Once born, girls face discrimination in the allocation of household resources. From the nutritional standpoint, Sen and Sengupta (1983) find a sharp bias against girls in terms of caloric intake in West Bengal and Behrman and Deolalikar (1988) report that the nutritional burden of a price rise falls disproportionately on women and girls. Jayachandran and Kuziemko (2011) find that mothers breastfeed daughters less than sons. A similar pattern has been noted in health expenditures, particularly when parents face a binding income constraint (Asfaw, Lamana and Klasen 2010 and Rose 1999). Finally, a number of studies have found evidence of gender discrimination in educational expenditures in India (Subramanian and Deaton

1991, Kingdon 2005, Lancaster, Maitra and Ray 2008 and Azam and Kingdon 2013).

There are multiple social and economic factors that contribute towards a pro-male bias, particularly in educational expenditure. Aside from cultural preferences and social norms in favor of sons, there are differences by gender in expectations of old age support, perceived returns to schooling, costs of education and availability of schools.[1] One channel through which the male bias may be intensified is parents choosing to invest disproportionately in the child who is designated to inherit and look after them in their old age. Ebenstein (2013) proposes patrilocality (i.e. co-residence with sons) as a key determinant of the sex ratio in developing countries. In Korea, where patrilocality is the norm, he finds evidence that the sex ratio improves following a pension expansion which makes parents less likely to be dependent on their children in the future. While parents have higher expectations from sons in general, in India it is the eldest son in particular who is the family heir and typically assumes responsibility for his parents and extended family (Dasgupta 1987, Mullatti 1995). In Hindu families the eldest son is also important for religious reasons and is responsible for performing the last rites of his parents. Jayachandran and Pande (2013) find evidence of better anthropometric outcomes for the eldest son in Indian families and attribute this to the special position that an eldest son enjoys.

Using data on educational expenditures and enrollment from the nationally representative India Human Development Survey (2004-05), I examine whether an inheritor (eldest male child) receives preferential treatment, and explore the extent to which the observed pro-male bias in educational expenditures and enrollment can be explained by this inheritor bias. Using child specific expenditures, I estimate a model of intra household discrimination with household fixed effects, controlling for

[1]See Alderman and King (1998) for a summary and review of evidence supporting different motives for gender discrimination.

the age and birth order of the child.[2]

I confirm the presence of a male bias and an additional preference for the likely inheritor in educational expenditures and enrollment. I also find that first born children receive preferential treatment. Taking the inheritor bias into account reduces the severity of the observed male bias. Next, I examine the behavior of households as the number of children increases and find that an increase in family size and greater competition for resources within the household causes the pro-male bias to fall and the inheritor bias to become greater. As income increases and parents are less likely to depend on their children for support, preferential treatment towards the inheritor declines. The inheritor bias is stronger in Hindu families. Finally, I study households in the state of Meghalaya, which follows a matrilineal system. In Meghalaya, as opposed to the rest of India, husbands move into the family home of their wives and the youngest daughter is the family heir (Gneezy, Leonard and List 2009). In line with the inheritor motive, the youngest girl appears to receive preferential treatment and I find evidence suggesting reverse discrimination, i.e. discrimination against sons in this state.

The chapter is organized as follows: Section 3.2 discusses motives for gender discrimination and makes the case for the importance of kinship norms. The data and sample are described in section 3.3 and section 3.4 discusses methodology. Results are presented in section 3.5. The final section concludes and describes avenue for future work.

[2]In their study using the same dataset, Azam and Kingdon (2013) control for age and gender but not for birth order in their individual level regressions. To the extent that parents may re-use books or uniforms bought for older children or expect older children to help care for younger ones, it is especially important to include this control when studying the inheritor motive.

3.2 Gender Discrimination and Kinship Norms

Kinship norms and social expectations play an important role in gender discrimination. In India, parents depend almost solely on their sons for old age support and daughters are not expected to contribute to the material well being of their natal families. Thus the perceived returns to educating a daughter are much lower than those for a son (Dasgupta 1987, Foster and Rosenzweig 2009). The prevalence of dowry in India makes daughters an additional liability and sons, an additional asset (Dasgupta et al. 2003). This gives parents an added incentive to invest in their son and make him as desirable as possible in the marriage market.

While sons in general are expected to provide for their parents, it is common practice in India for the eldest son of the household to inherit the bulk of the family estate and continue to live with his parents in what is known as a joint family. The joint family often includes younger brothers and their families, along with any unmarried siblings. In Hindu tradition, the eldest son is also responsible for carrying out the last rites of his parents, paying obeisance to family gods and performing rituals in the memory of common ancestors (Arnold et al. 1998, Mullatti 1995). It is considered the religious duty of the eldest son to look after the remaining members of the family in the absence of his parents. Thus, families have a strong motive to invest in the inheritor, which is typically the eldest son. In the joint family set up, the eldest son of the eldest son will enjoy privileges over his cousins and siblings. Inheritance passes to the son of the eldest son of the household, even if he has a cousin who is older than him, but is the son of a younger son of the family head. Studies on health outcomes of children find evidence in support of an eldest son preference. Jayachandran and Pande (2013) find that the eldest son in India families has much better anthropometric outcomes compared to other children and Coffey, Khera and

Spears (2013) find evidence of preferential treatment in joint families to children of the eldest son (daughter in law).

The literature on parental motivation suggests that when one or more of the factors affecting gender discrimination are altered, parents may change patterns of allocation. Jensen (2012) finds that providing recruiting services to young women in villages in India improves girls' educational and health outcomes. The experimental results suggest that an increase in the perceived returns to education makes parents more likely to invest in their daughters. The importance of access to school (through distance to school) has been studied in many developing countries including Malaysia, India, Indonesia, Pakistan, Peru and Philippines (Alderman and King 1998, Duflo 2001). Alderman et al. (1996) find that distance to school has a negative impact only on the enrollment of girls in Pakistan. Muralidharan and Prakash (2013) report that a policy of providing cycles to girls in Bihar, in India, makes them stay in school longer. The effect is the strongest for girls who live further away from school, suggesting that the channel through which the policy works is easier and safer access to schools. This suggests that heterogeneity in incentives due to factors such as income, size, religion and location of the household should be taken into account when studying the inheritor motive.

While there is diversity across regions in the autonomy enjoyed by women and the strength of ties with their natal families (Dyson and Moore 1983, Dasgupta 1987), the state of Meghalaya is a clear exception. Meghalaya is one of the last surviving matrilineal societies in the world (Gneezy, Leonard and List 2009). It has a unique social structure where family property is inherited by the youngest daughter. She continues to reside with her husband in her mother's family home after marriage. Women also typically have control over family resources and their allocation. Thus

Meghalaya makes for an interesting case study and counter point to the rest of the country.

3.3 Data

3.3.1 Data and Sample

The India Human Development Survey 2004-05 (IHDS), which is jointly conducted by the National Council of Applied Economic Research in Delhi and the University of Maryland (Desai, Vanneman, & National Council of Applied Economic Research, 2005), is nationally representative and covers 41,554 households in 1,503 villages and 971 urban regions across the country. The IHDS is a multi-topic survey that collects information on economic status, employment, education, demographics, health, gender relations and social capital.

In addition to information on household characteristics, the survey includes child specific educational variables such as type of school, distance from the school, hours spent in school work, government assistance, and expenditure on school fees, private tuitions, uniforms and books. This information is collected for every child in the household and anthropometrics and learning tests are conducted for up to two children. The data allows for the estimation of a household fixed effects model using actual child level expenditure, instead of budget shares and demographics.

The sample for analysis comprises children between the ages of 4 and 18 who have at least one other sibling in the same age group.[3] For every child, I calculate total educational expenditure as the sum of school fees, private tuitions fees and expen-

[3] The school going age in India is between 4 and 18. Of the sample of children with positive educational expenses, less than 1 percent are below age 4. Restricting the sample to ages 4-15 accounts for eighty four percent of the remaining children and including ages 16-18 raises this to ninety six percent.

diture on books and uniforms in the last year. For children that are not enrolled in school, I assign a value of zero. I create an inheritor indicator which captures the male heir for families in every state except Meghalaya. The male heir is defined as either the eldest son of the head of the household, or the eldest son of the eldest son of the head of the household. In Meghalaya, the heir is the youngest daughter, or her youngest daughter. Given that this state is so different from the rest of the country, I drop it from the main sample and analyze Meghalaya separately.[4] The final analytic sample includes 64,533 children from 25,568 households.

3.3.2 Descriptive Statistics

From Table 3.1, households in the sample have an average of three children and sixty seven percent live in rural areas. Education accounts for over five percent percent of total household expenditure. Over ninety one percent of women lived with their husband's family after getting married and seventy nine percent of them expect to live with their son when they are older. Seventy six percent expect their son to support them financially, while less than four percent expect support from their daughters. Thus, clearly the majority of mothers have the expectation that their son will provide and care for them. Eighty five percent believe that girls and boys should be educated equally.

Table 3.2 presents summary statistics for all children in the sample. Over half the children are male, seventy two percent are enrolled in school and a fourth of the sample are inheritors. Boys have fewer siblings than girls, enjoy higher rates of enrollment, higher educational expenses and spend more time per week on school

[4]The analysis for Meghalaya finds that parents discriminate in favor of girls i.e. not only is the male bias is reversed, but given the fact that women have fewer outside opportunities, girls in Meghalaya receive more preferential treatment than boys in the rest of the country. Unfortunately, the effect is not significant after controlling for the inheritor motive, as there are only 256 children from Meghalaya and over 64,533 children from the rest of India. See section 3.5.6 ahead.

work. The average age for both boys and girls is eleven years and girls are more likely to receive government assistance and attend government schools.

Statistics by gender and birth order (Table 3.3) suggest that the pattern of discrimination is similar for boys and girls of the same birth order. Though parents spend more on the education of first born girls as compared to younger boys, this could be driven by school expenses rising with age. Of all categories of children, inheritors have the highest enrollment rate: seventy seven percent.

3.4 Methodology

I estimate the following household fixed effects model for each child in the sample:

$$Y_{ih} = \alpha + \mu_h + \beta Inheritor_{ih} + \theta Male_{ih} + \gamma First_{ih} + \chi Age_{ih} + \epsilon_{ih}$$

where Y_{ih} represents the outcome variable for child i in household h. μ_h are household fixed effects, $Inheritor_{ih}$ is an indicator for being the family heir, $Male_{ih}$ is the indicator for being a son, Age_{ih} are indicators for the ages 4 to 18, and $First_{ih}$ is an indicator for being the first child born in the family. Standard errors are heteroskedasticity-consistent. The main outcome variable is child level educational expenditure, scaled by per capital household expenditure. I also check for discrimination on the extensive margin by studying the enrollment decision for all children between the ages of 4 and 18.

Using a fixed effects model controls for household characteristics that may affect educational expenditure. Any pro-male bias is captured by the male indicator and age indicators account for differences in expenditures based on grade – a higher grade is associated with more expenditure on books, fees etc. The main parameter of interest is β, the coefficient on the indicator for being the inheritor. Give that the inheritor is also likely to be a first born child, an indicator for being the first born is included, since there is some evidence that a higher birth order affects earnings and schooling (Behrman and Taubman, 1986 and Ejrnaes and Portner, 2004).

Table 3.4 shows the combinations of coefficients that apply to different children. Given the joint family structure, a first born boy need not not be the inheritor if he happens to be the son of a younger son of the head of the household. Thus the inheritor indicator is not a pure interaction between first born and male. In order to examine the mechanism through which the inheritor motive works, I also study the sample of children by number of siblings, income and education of parents, location and religion. Finally, I analyze the behaviour of parents in Meghalaya, which follows a matrilineal system.

3.5 Results

3.5.1 Educational Expenses and the Enrollment Decision

Table 3.5 presents results for the main regression. Panel A checks for discrimination in educational expenses for children who are enrolled. The dependent variable is child specific educational expenditure, scaled by the per capita household expenditure. Column 1 estimates the regression with household fixed effects, an indicator for being male, and age indicators. As expected, the coefficient on being male is positive and significant. Column 2 includes an indicator for being the oldest child. While this does not affect the male bias, it is clear that parents favor the first born child. The interaction term between first born and male is not significant in column 3 which suggests that parents don't discriminate in favor of the first born boy over a first born girl, conditional on her being enrolled. Column 4 adds the indicator for being the inheritor. This significantly reduces the male bias. The coefficient on the inheritor indicator is positive and significant, suggesting that parents invest additionally in this child. Aside from being male, inheritors are also likely to be the first born and hence receive a combination of the coefficients on male, inheritor and first born.

Panel B presents results from a linear probability model for the enrollment decision. The sample comprises all children of school going age. The male bias is strong and persistent across all specifications. From column 4 it is clear that parents give preferential treatment to the inheritor, over and above any preference for first born and male children. Column 3 suggests that the first born bias is entirely driven by boys, implying that first born girls are not any more likely to be enrolled as compared to other girls. Thus, a first born boy is more likely to be enrolled than a first born girl, but conditional on enrollment, all first born children receive preferential treatment in expenditure. Overall, the evidence suggests that in both the enrollment and expenditure decision, parents favor the inheritor and accounting for this reduces the observed male bias. The coefficient on male from columns 5 and 3 suggests that beyond a first born and male bias, there is an inheritor bias which extends to sons who may be born second, but are the oldest son.[5] As a robustness check, I restrict the sample to nuclear families where all first born male children are necessarily inheritors.[6] The identification in this sample comes from comparing second (later) born males who have older brothers, with second born males who have older sisters. The results (in Table 3.6) are almost identical to the full sample

[5] Weighting the regressions based on the number of children in each household does not change the results.

[6] In the full sample (including joint families) six percent of the eldest male children in the household are not inheritors, as they are children of the younger son of the head (grandfather) of the household.

results, confirming that the positive bias for inheritors is not a feature specific only to large joint families.[7]

3.5.2 Impact by Family Size

As the number of siblings increases, so does the competition for resources within the family. The role of family size is examined in Table 3.7, which splits the sample based on the number of children in the household. For educational expenditure in Panel A, as household size increases, the first born premium declines, while the inheritor bias increases. This suggests that in larger families, parents pay special attention to the inheritor. Accounting for the inheritor bias reduces the male bias for all households. In the enrollment decision (panel B of Table 3.7), the male bias is strong and being the first born or the inheritor are not as important. However, in larger families, the inheritor is much more likely to be enrolled.

Descriptive statistics based on family size in Table 3.8 show that family income declines somewhat with size. Larger households are also much more likely to be rural and spend a lower proportion of total income on education.[8] Given the negative correlation between size and economic status, it is not surprising that parents with more children are more likely to invest in the inheritor. Also, if parents view children as a form of security for old age, they are likely to have larger families and invest more in the most likely inheritor. The statistics on gender relations confirms that as family size increases, a higher proportion of parents expect to live with their sons and receive financial support from them in old age.

[7] In nuclear families, all first born*males are inheritors but all inheritors are not the first born child. Approximately half of all inheritors have sisters who are older than them. Thus, the first born*male indicator in column 3 of Table 3.6 picks up only half of the inheritors in the sample.

[8] This could be because schools in rural areas are cheaper, i.e. more government (free) schools as opposed to private ones.

3.5.3 Impact by Income

If the inheritor bias is motivated by parents investing in the child most likely to take care of them when they grow older, this bias should decline as income of the household increases. For households that are better off, children are less likely to be viewed as a form of security for old age. From Panel A of Table 3.9, the inheritor bias in educational expenditure is smaller for households with income above the median. The male bias is fairly stable and the first born bias increases with income. Panel B, which tracks the enrollment decision shows a somewhat different pattern. Parents in the lower half of the distribution show a strong male and inheritor bias. As expenditure (income) rises, the inheritor bias in enrollment disappears and both the male and first born biases are much less strong. This suggests that parents in the higher expenditure bracket discriminate less: both on the intensive and extensive margin. Table 3.10 presents descriptive statistics for children, split by income. Enrollment rates in the top income bracket are much closer for girls and boys, but on average, more boys go to (more expensive) private school as compared to girls.

3.5.4 Impact by Location

The impact of location is considered in Table 3.11. In Panel A, the inheritor bias in educational expenditure is stronger in rural areas. This is in line with the reasoning that urban parents may have less expectations of support from their children in the future. In the enrollment decision (Panel B), the male bias disappears in urban areas when the first born and inheritor indicators are introduced.

3.5.5 Impact by Religion

Hindu families may have a particularly strong preference for the eldest son, who is not only the head of the Hindu undivided family, but is also responsible for lighting the funeral pyres of his parents and for praying for the family's ancestors. (Arnold et al., 1998). In Table 3.12, I check for a differential pattern in discrimination, by religion. Panel A shows that Hindu families exhibit a stronger male preference than Non-Hindu families in educational expenditure. The latter don't appear to favor the inheritor child in particular (column 4), which is consistent with the idea of the eldest male occupying a special position in Hindu rituals. A similar pattern is seen in Panel B, which tracks the enrollment decision.

3.5.6 Reverse Discrimination in Meghalaya

The state of Meghalaya has one of the last surviving matrilineal societies in the world. The youngest girl inherits the family property and the norm is for women to continue to co-reside with their parents after marriage. Thus parents have an incentive to invest heavily in girls, and in particular in the youngest daughter.[9] Table 3.13 presents descriptive statistics for children in Meghalaya. In a complete reversal of trends compared to the rest of the country, boys are likely to have more siblings than girls, they receive much lower educational expenditures, they have a lower rate of enrollment and spend significantly fewer hours on school work. This is suggestive of reverse discrimination.

The regression results from Table 3.14 are consistent with the hypothesis that parents in Meghalaya favor girls. For educational expenditure, the coefficient on being male is similar in magnitude to the coefficient for the rest of India, but is negative. Due to the small size of the sample, it is not significant. In the enrollment decision, parents appear to discriminate against the first born child, which is also in contrast to the rest of the country, but is consistent with parents wanting to invest in the

[9] Gneezy, Leonard and List (2009) exploit Meghalaya's unique social structure to test whether men are inherently more competitive than women. In contrast to women from the patriarchal Masai tribe in Africa, they find that Khasi women from Meghalaya are more likely to be competitive than men.

inheritor, in this case the youngest daughter.

Meghalaya is different not just because the inheritor is the youngest girl, but also because mothers are largely incharge of household funds and decisions. Duflo (2003) finds that cash transfers to grand mothers in South Africa have a large impact on health outcomes of grand daughters and little effect on grand sons. In Brazil, Thomas (1990) finds some evidence of 'gender matching' in allocation of resources in the household, i.e. mothers favor daughters and fathers favor sons. Thus, it is not surprising to see a strong preference for sons, particularly in patriarchal societies like the rest of India, where men typically have control of family funds and allocation decisions. The results from Meghalaya conform to gender matching in allocation. However, gender matching alone does not explain why parents would invest less in the first born child. Due to the small size of the sample, it is not possible to make causal inferences from the analysis. However, the results from Meghalaya suggest that parents do invest more heavily in the child that is the most likely to support them in the future.

3.6 Conclusion

This paper examines one channel that possibly intensifies the male bias observed in the allocation of household resources. In the context of educational expenditures on children, the results suggest that parents, who expect to live with and receive support from their eldest son in the future, invest the most in his education. The gender bias and inheritor bias in enrollment are much smaller, and disappear for families with higher incomes. In Meghalaya, which follows a matrilineal system, there appears to be reverse discrimination, i.e. in favor of girls.

Gender discrimination within the household has broader consequences for development and growth (Klasen 2002, Schultz 2002). There are many channels that influence parental decisions ranging from an inherent preference for boys to differences in access and returns to education for boys and girls. The lack of a safety net for the future could be a factor that exacerbates the bias. It would be interesting to study whether parents discriminate less if their outside options in terms of old age support increase. Another aspect of gender discrimination is the role played by mothers. Are they inherently less discriminatory and does putting them in charge of family funds reduce discrimination? Though matrilineal societies are rare, they provide a unique perspective on gender dynamics. Studying matrilineal societies in North and West Africa could provide further insights into the impact of women being in the position of power on household decisions.

Table 3.1: Household descriptive statistics

	Mean	(Std. Deviation)
Demographics		
Size of the household	6.147	(2.394)
No. of children	3.310	(1.522)
Monthly consumption per capita (Rs)	789.5	(696.9)
Education as a proportion of expenditure	0.0550	(0.112)
Urban	0.333	(0.471)
Gender relations		
Lived with husband's family	0.914	(0.280)
Lived with wife's family	0.0257	(0.158)
Lived alone	0.0599	(0.237)
Expect to live with son	0.786	(0.410)
Expect to live daughter	0.0360	(0.186)
Expect financial support from son	0.762	(0.426)
Expect financial support from daughter	0.0390	(0.194)
Educate girls equally	0.853	(0.354)
Educate girls less	0.117	(0.322)
Educate girls more	0.0293	(0.169)
Observations	25568	

Notes: 1. The sample comprises households with two or more children. 2. Households from Meghalaya are dropped.

Table 3.2: Individual (child) descriptive statistics

Sample:	All	Boys	Girls
Inheritor	0.261	0.496	0
	(0.439)	(0.500)	(0)
No. of siblings	2.884	2.792	2.986
	(1.889)	(1.887)	(1.887)
Age	10.91	10.95	10.87
	(4.227)	(4.274)	(4.175)
Currently enrolled	0.725	0.739	0.710
	(0.446)	(0.439)	(0.454)
Annual educ. expenses (Rs)	1291.1	1390.8	1180.8
	(2767.2)	(2913.5)	(2591.2)
Time spent studying (hours)	27.54	28.15	26.87
	(22.06)	(21.92)	(22.20)
Any govt. assistance	0.700	0.675	0.728
	(0.458)	(0.468)	(0.445)
Attends govt. school	0.690	0.669	0.715
	(0.462)	(0.471)	(0.452)
Educ. expenses/per	0.127	0.137	0.116
capita hhd. expenses	(0.275)	(0.292)	(0.254)
Observations	64533	33912	30621

Note: 1. Mean of each variable with standard deviation in parentheses. 2. The sample comprises all children between the ages of 4 and 18 in households with more than two children. 3. Children from Meghalaya are dropped.

Table 3.3: Child descriptive statistics, by gender and birth order

Sample:	First Born		Later Born		Inheritor	Non-Inheritor
	Male	Female	Male	Female		
Inheritor	0.942		0.295		1	
	(0.234)		(0.456)		(0)	
No. of siblings	2.170	2.377	3.073	3.272	2.319	3.084
	(1.472)	(1.517)	(1.984)	(1.973)	(1.488)	(1.974)
Age	11.77	11.58	10.58	10.54	11.21	10.81
	(4.339)	(4.215)	(4.191)	(4.115)	(4.279)	(4.204)
Currently enrolled	0.745	0.715	0.737	0.708	0.766	0.711
	(0.436)	(0.451)	(0.441)	(0.455)	(0.423)	(0.453)
Annual educ. expenses (Rs)	1724.3	1482.4	1239.9	1039.6	1631.4	1171.1
	(3502.7)	(3039.2)	(2589.4)	(2339.0)	(3233.5)	(2571.9)
Time spent studying (hours)	28.74	27.41	27.88	26.62	29.61	26.81
	(22.48)	(22.53)	(21.66)	(22.04)	(21.93)	(22.06)
Any govt. assistance	0.638	0.693	0.691	0.744	0.643	0.720
	(0.480)	(0.461)	(0.462)	(0.437)	(0.479)	(0.449)
Attends govt. school	0.634	0.674	0.684	0.734	0.645	0.707
	(0.482)	(0.469)	(0.465)	(0.442)	(0.479)	(0.455)
Educ. expenses/per capita hhd. expenses	0.162	0.139	0.125	0.106	0.155	0.117
	(0.301)	(0.352)	(0.287)	(0.190)	(0.344)	(0.245)
Observations	10563	9765	23349	20856	16834	47699

Note: 1. Mean of each variable with standard deviation in parentheses.

Table 3.4: Coefficients for different children

	Male - Inheritor	Male - Not Inheritor	Girl
First Born	$\alpha+\beta+\gamma+\theta+\chi_i$	$\alpha+\gamma+\theta+\chi_i$	$\alpha+\gamma+\chi_i$
Not First Born	$\alpha+\beta+\theta+\chi_i$	$\alpha+\theta+\chi_i$	$\alpha+\chi_i$

Coefficients represent the following indicators: θ - male, β - inheritor, γ - first born and χ_i - ages 5 to 18.

Table 3.5: Educational expenses and enrollment

Panel A	Dependent variable: Child educational expenses/ per capita household expenditure				
	(1)	(2)	(3)	(4)	(5)
Male child	0.0229***	0.0227***	0.0219***	0.0163***	0.0134***
	(0.00188)	(0.00188)	(0.00209)	(0.00244)	(0.00239)
First Born		0.0203***	0.0189***	0.0181***	
		(0.00326)	(0.00365)	(0.00351)	
Inheritor				0.0100***	0.0148***
				(0.00320)	(0.00290)
First Born*Male			0.00272		
			(0.00450)		
Constant	0.0697***	0.0794***	0.0797***	0.0814***	0.0741***
	(0.00866)	(0.00902)	(0.00907)	(0.00900)	(0.00872)
Observations	43491	43491	43491	43491	43491
Adjusted R^2	0.114	0.117	0.117	0.117	0.115
Panel B	Dependent variable: Enrolled (1,0 dummy)				
	(1)	(2)	(3)	(4)	(5)
Male child	0.0508***	0.0508***	0.0411***	0.0414***	0.0383***
	(0.00335)	(0.00335)	(0.00393)	(0.00448)	(0.00444)
First Born		0.0184***	0.000238	0.0144***	
		(0.00406)	(0.00565)	(0.00419)	
Inheritor				0.0157***	0.0206***
				(0.00457)	(0.00444)
First Born*Male			0.0353***		
			(0.00742)		
Constant	0.262***	0.267***	0.272***	0.270***	0.268***
	(0.00899)	(0.00918)	(0.00924)	(0.00926)	(0.00915)
Observations	64533	64533	64533	64533	64533
Adjusted R^2	0.277	0.277	0.277	0.277	0.277

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All regressions include age indicators and household fixed effects. 2. Standard errors are robust.

Table 3.6: Educational expenses and enrollment for nuclear families

Panel A	Dependent variable: Child educational expenses/ per capita household expenditure				
	(1)	(2)	(3)	(4)	(5)
Male child	0.0225***	0.0222***	0.0216***	0.0155***	0.0135***
	(0.00214)	(0.00216)	(0.00233)	(0.00275)	(0.00263)
First Born		0.0163***	0.0152***	0.0143***	
		(0.00404)	(0.00457)	(0.00445)	
Inheritor				0.00982***	0.0132***
				(0.00355)	(0.00304)
First Born*Male			0.00215		
			(0.00495)		
Constant	0.0474***	0.0577***	0.0579***	0.0604***	0.0529***
	(0.0101)	(0.0109)	(0.0109)	(0.0107)	(0.0102)
Observations	35121	35121	35121	35121	35121
Adjusted R^2	0.116	0.117	0.117	0.118	0.117
Panel B	Dependent variable: Enrolled (1,0 dummy)				
	(1)	(2)	(3)	(4)	(5)
Male child	0.0526***	0.0525***	0.0433***	0.0444***	0.0427***
	(0.00376)	(0.00376)	(0.00440)	(0.00519)	(0.00516)
First Born		0.0131***	-0.00418	0.0102**	
		(0.00482)	(0.00654)	(0.00495)	
Inheritor				0.0128**	0.0155***
				(0.00521)	(0.00507)
First Born*Male			0.0340***		
			(0.00838)		
Constant	0.258***	0.264***	0.269***	0.268***	0.264***
	(0.0114)	(0.0118)	(0.0119)	(0.0120)	(0.0117)
Observations	52462	52462	52462	52462	52462
Adjusted R^2	0.270	0.270	0.271	0.270	0.270

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All regressions include age indicators and household fixed effects. 2. Standard errors are robust. 3. Sample restricted to nuclear families.

Table 3.7: Educational expenses and enrollment, by number of children

Panel A	Dependent variable: Child educational expenses / per capita household expenditure					
Sample:	2 children		3 children		>3 children	
	(1)	(2)	(3)	(4)	(5)	(6)
Male child	0.0135**	0.0176**	0.0241***	0.0183***	0.0256***	0.0158***
	(0.00545)	(0.00738)	(0.00339)	(0.00460)	(0.00241)	(0.00313)
First Born		0.0311***		0.0197***		0.0178***
		(0.00833)		(0.00417)		(0.00534)
Inheritor		-0.00390		0.00818*		0.0193***
		(0.00638)		(0.00444)		(0.00577)
Constant	0.101***	0.135***	0.0464**	0.0638***	0.0656***	0.0732***
	(0.0156)	(0.0190)	(0.0214)	(0.0218)	(0.0105)	(0.0108)
Observations	11112	11112	12858	12858	19521	19521
Adjusted R^2	0.095	0.099	0.151	0.155	0.107	0.111

Panel B	Dependent variable: Enrolled (1,0 dummy)					
Sample:	2 children		3 children		>3 children	
	(1)	(2)	(3)	(4)	(5)	(6)
Male child	0.0266***	0.0196*	0.0470***	0.0391***	0.0602***	0.0471***
	(0.00671)	(0.0118)	(0.00575)	(0.00789)	(0.00486)	(0.00589)
First Born		0.0264***		0.0215***		0.000329
		(0.0102)		(0.00789)		(0.00647)
Inheritor		0.00803		0.0117		0.0279***
		(0.0104)		(0.00791)		(0.00686)
Constant	0.351***	0.385***	0.284***	0.302***	0.204***	0.209***
	(0.0223)	(0.0256)	(0.0176)	(0.0187)	(0.0117)	(0.0118)
Observations	15103	15103	18116	18116	31314	31314
Adjusted R^2	0.250	0.251	0.280	0.281	0.285	0.286

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All regressions include age indicators and household fixed effects. 2. Standard errors are robust.

Table 3.8: Descriptive statistics for households, by number of children

Sample:	2 children	3 children	>3 children
Demographics			
Monthly consumption per capita (Rs)	55314.2	48147.8	53526.5
	(71014.7)	(92975.4)	(83159.4)
Urban	0.400	0.330	0.263
	(0.490)	(0.470)	(0.440)
Education as a proportion of expenditure	0.0594	0.0561	0.0493
	(0.153)	(0.0777)	(0.0833)
Gender relations			
Expect to live with son	0.733	0.807	0.824
	(0.442)	(0.395)	(0.381)
Expect to live with daughter	0.0547	0.0316	0.0198
	(0.227)	(0.175)	(0.139)
Expect financial support from son	0.705	0.782	0.808
	(0.456)	(0.413)	(0.394)
Expect financial support from daughter	0.0576	0.0339	0.0235
	(0.233)	(0.181)	(0.152)
Observations	9283	7701	8584

Note: 1. Mean of each variable with standard deviation in parentheses.

Table 3.9: Educational expenses and enrollment, by household expenditure

Panel A	Dependent variable: Child educational expenses/ per capita household expenditure			
Sample:	Below median expenditure		Above median expenditure	
	(1)	(2)	(3)	(4)
Male child	0.0178***	0.0106***	0.0261***	0.0207***
	(0.00309)	(0.00355)	(0.00231)	(0.00330)
First Born		0.0142**		0.0230***
		(0.00669)		(0.00346)
Inheritor		0.0119**		0.00764**
		(0.00582)		(0.00358)
Constant	0.0713***	0.0785***	0.0750***	0.0911***
	(0.0162)	(0.0163)	(0.0101)	(0.0108)
Observations	18834	18834	24657	24657
Adjusted R^2	0.113	0.115	0.121	0.126
Panel B	Dependent variable: Enrolled (1,0 dummy)			
Sample:	Below median expenditure		Above median expenditure	
	(1)	(2)	(3)	(4)
Male child	0.0673***	0.0538***	0.0349***	0.0288***
	(0.00501)	(0.00641)	(0.00428)	(0.00606)
First Born		0.00102		0.0222***
		(0.00625)		(0.00556)
Inheritor		0.0243***		0.00949
		(0.00685)		(0.00596)
Constant	0.145***	0.151***	0.389***	0.400***
	(0.0111)	(0.0114)	(0.0150)	(0.0155)
Observations	32302	32302	32231	32231
Adjusted R^2	0.324	0.324	0.224	0.226

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All regressions include age indicators and household fixed effects. 2. Standard errors are robust.

Table 3.10: Descriptive statistics for children, by household expenditure

Sample:	Below median expenditure			Above median expenditure		
	All	Boys	Girls	All	Boys	Girls
Male child	0.516			0.535		
	(0.500)			(0.499)		
Inheritor	0.240	0.318	0.164	0.281	0.367	0.200
	(0.427)	(0.466)	(0.371)	(0.450)	(0.482)	(0.400)
Age	10.47	10.59	10.53	11.35	11.44	11.44
	(4.175)	(4.211)	(4.165)	(4.234)	(4.257)	(4.216)
Currently enrolled	0.638	0.658	0.643	0.813	0.829	0.826
	(0.481)	(0.474)	(0.479)	(0.390)	(0.377)	(0.379)
Annual educ. expenses (Rs.)	428.8	484.8	465.5	2155.4	2486.7	2496.5
	(870.7)	(933.9)	(916.4)	(3616.6)	(3978.7)	(4020.2)
Time spent studying (hours)	22.95	23.85	23.28	32.14	33.02	32.91
	(21.12)	(21.16)	(21.21)	(22.02)	(22.06)	(22.16)
Any govt. assistance	0.849	0.826	0.840	0.550	0.507	0.515
	(0.358)	(0.379)	(0.367)	(0.497)	(0.500)	(0.500)
Attends govt. school	0.829	0.812	0.820	0.578	0.541	0.547
	(0.376)	(0.391)	(0.385)	(0.494)	(0.498)	(0.498)
Observations	32302	24385	24007	32231	24681	23648

Note: 1. Mean of each variable with standard deviation in parentheses.

Table 3.11: Educational expenses and enrollment, by location

Panel A	Dependent variable: Child educational expenses/ per capita household expenditure			
Sample:	Urban		Rural	
	(1)	(2)	(3)	(4)
Male child	0.0290***	0.0240***	0.0196***	0.0125***
	(0.00396)	(0.00482)	(0.00201)	(0.00280)
First Born		0.0257***		0.0139***
		(0.00535)		(0.00449)
Inheritor		0.00619		0.0114***
		(0.00523)		(0.00401)
Constant	0.103***	0.120***	0.0619***	0.0708***
	(0.0118)	(0.0128)	(0.0126)	(0.0128)
Observations	14732	14732	28759	28759
Adjusted R^2	0.106	0.111	0.121	0.123

Panel B	Dependent variable: Enrolled (1,0 dummy)			
Sample:	Urban		Rural	
	(1)	(2)	(3)	(4)
Male child	0.0155***	0.00574	0.0658***	0.0552***
	(0.00554)	(0.00777)	(0.00413)	(0.00542)
First Born		0.0308***		0.00884*
		(0.00709)		(0.00514)
Inheritor		0.0149*		0.0181***
		(0.00772)		(0.00559)
Constant	0.430***	0.446***	0.192***	0.200***
	(0.0176)	(0.0183)	(0.0104)	(0.0107)
Observations	20020	20020	44513	44513
Adjusted R^2	0.226	0.228	0.299	0.300

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All regressions include age indicators and household fixed effects.

2. Standard errors are robust.

Table 3.12: Educational expenses and enrollment, by religion

Panel A	Dependent variable: Child educational expenses/ per capita household expenditure			
Sample:	Hindu		Non-Hindu	
	(1)	(2)	(3)	(4)
Male child	0.0256***	0.0179***	0.0149***	0.0120***
	(0.00222)	(0.00295)	(0.00344)	(0.00410)
First Born		0.0176***		0.0193***
		(0.00444)		(0.00482)
Inheritor		0.0111***		0.00488
		(0.00386)		(0.00490)
Constant	0.0652***	0.0787***	0.0798***	0.0867***
	(0.0104)	(0.0110)	(0.0158)	(0.0160)
Observations	33277	33277	10214	10214
Adjusted R^2	0.111	0.113	0.133	0.136

Panel B	Dependent variable: Enrolled (1,0 dummy)			
Sample:	Hindu		Non-Hindu	
	(1)	(2)	(3)	(4)
Male child	0.0517***	0.0436***	0.0502***	0.0369***
	(0.00386)	(0.00527)	(0.00671)	(0.00849)
First Born		0.0152***		0.00457
		(0.00488)		(0.00837)
Inheritor		0.0130**		0.0247***
		(0.00523)		(0.00945)
Constant	0.266***	0.274***	0.241***	0.249***
	(0.0106)	(0.0110)	(0.0169)	(0.0172)
Observations	47596	47596	16937	16937
Adjusted R^2	0.283	0.284	0.266	0.267

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All regressions include age indicators and household fixed effects.

2. Standard errors are robust.

Table 3.13: Descriptive statistics for Meghalayan children

Sample:	Boys	Girls
Inheritor	0	0.527
	(0)	(0.502)
No. of siblings	2.963	2.688
	(1.605)	(1.433)
Age	10.84	10.88
	(4.269)	(4.429)
Currently enrolled	0.724	0.741
	(0.449)	(0.440)
Annual educ. expenses (Rs)	1680.3	1946
	(2790.3)	(2967.1)
Time spent studying (hours)	16.83	25.30
	(18.04)	(20.83)
Any govt. assistance	0.455	0.446
	(0.500)	(0.499)
Attends govt. school	0.700	0.625
	(0.461)	(0.487)
Educ. expenses/ per	0.114	0.131
capita hhd. expenses	(0.158)	(0.180)
Observations	134	112

Note: 1. Mean of each variable with standard deviation in parentheses.

Table 3.14: Educational expenses and enrollment for Meghalayan children

Dependent variable:	Child educational expenses/per capita household expenditure				Enrolled (1,0 dummy)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male child	-0.0447	-0.0454	-0.0571	-0.0179	0.00322	0.00612	-0.0317	0.0521
	(0.0325)	(0.0324)	(0.0353)	(0.0522)	(0.0609)	(0.0593)	(0.0590)	(0.0768)
First Born		0.0232	-0.0127	0.0250		-0.110*	-0.203**	-0.109*
		(0.0169)	(0.0310)	(0.0171)		(0.0606)	(0.102)	(0.0614)
Inheritor				0.0414				0.0707
				(0.0473)				(0.0828)
First Born*Male			0.0621				0.169	
			(0.0404)				(0.123)	
Constant	0.128***	0.151***	0.154***	0.112*	0.330**	0.280*	0.287**	0.212
	(0.0231)	(0.0255)	(0.0235)	(0.0581)	(0.148)	(0.145)	(0.143)	(0.159)
Observations	170	170	170	170	246	246	246	246
Adjusted R^2	0.405	0.405	0.409	0.410	0.258	0.269	0.275	0.270

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: 1. All regressions include age indicators and household fixed effects. 2. Standard errors are robust.

Chapter A: Appendix for Chapter 2

Table A. Per capita purchase of PDS Rice

	Mean (kg)	Std. Dev.	N
Assam	7.29	3.5	909
West Bengal	2.82	2.46	1914
Orissa	6.60	3.63	2287
Jharkhand	4.74	2.41	269
Chattisgarh	9.09	4.07	1169
Andhra Pradesh	5.07	2.50	12345
Karnataka	5.05	2.49	5062
Kerala	5.50	3.49	4259
Full Sample	5.34	3.1	28214

Note: The sample comprises PDS rice users.

Table B. Price paid per calorie by food group

Foodgroup:	Cereals	Lentils	Vegetables	Meat
Mean (Rs/1000 kcal)	2.40	8.46	18.89	41.45
Std. Dev.	0.63	2.80	6.48	19.42

Note: Price calculations based on quantity and value reported by PDS rice users.

Table C. BPL and Antyodaya Households - IHDS and NSSO 61st round data

Sample:	BPL		Antyodaya	
Data:	IHDS	NSSO	IHDS	NSSO
Monthly expenditure per capita (Rs)	660.3	558.5	485.3	478.9
	(539.4)	(306.4)	(481.2)	(309.5)
Monthly income per capita (Rs)	606.5		471.0	
	(785.6)		(370.1)	
PDS rice price (Rs/kg)	4.475	5.399	3.329	3.461
	(1.493)	(1.290)	(0.954)	(0.983)
Market rice price (Rs/kg)	10.54	10.53	9.753	10.09
	(2.227)	(2.016)	(1.634)	(2.049)
PDS rice Qty (kg)	18.60	17.95	24.71	23.73
	(6.766)	(8.513)	(9.438)	(10.81)
Market rice Qty (kg)	23.08	25.29	25.67	16.68
	(22.63)	(20.88)	(26.31)	(20.38)
Daily cereal consumption per capita (kg)	0.441	0.467	0.538	0.496
	(0.170)	(0.136)	(0.195)	(0.186)
Rice subsidy per capita (Rs)	27.23	24.97	32.47	30.85
	(15.42)	(14.29)	(23.30)	(23.90)
Observations	4196	7405	283	788

Notes: 1. Means with standard deviations in parentheses. 2. The sample comprises PDS rice users from the 61st round (2004-05) of the NSSO surveys and the India Human Development Survey 2005.

Table D. PDS Rice users - IHDS and NSSO

Data:	IHDS	NSSO
Monthly expenditure per capita (Rs)	625.1	596.7
	(442.2)	(362.4)
Monthly income per capita (Rs)	587.5	
	(567.3)	
PDS rice price (Rs/kg)	4.546	5.237
	(1.612)	(1.627)
Market rice price (Rs/kg)	10.48	10.56
	(1.906)	(2.122)
PDS rice qty (kg)	19.16	18.54
	(7.253)	(8.785)
Market rice qty (kg)	24.52	27.97
	(23.03)	(21.37)
Daily cereal consumption per capita (kg)	0.434	0.475
	(0.158)	(0.129)
Rice subsidy per capita (Rs)	25.46	24.17
	(11.18)	(11.37)
Observations	3962	4255

Notes: 1. Means with standard deviations in parentheses. 2. The sample comprises PDS rice users (November 2004 to October 2005) from the NSSO surveys and the India Human Development Survey 2005.

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