Labor Market Effects of Social Transfers: Evidence from India's Public Distribution System

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Abstract

Social transfers have become an increasingly common form of social protection for the poor across the developing world, but their labor market effects are not well understood. In this paper, we estimate the effect of a large increase in social transfers on labor supply and wages in India. Our empirical analysis exploits changes in the generosity of the Public Distribution System, an in-kind food transfer program, brought about by the National Food Security Act of 2013. Using detailed individual data on transfer eligibility, labor supply and wages, we find that larger transfers led to lower labor supply and higher wages, and that these effects benefited the poor. The effect on labor supply and wages is particularly strong in years with bad productivity shocks, which suggests that social transfers can help prevent the vicious cycle of low wages and high labor supply that afflicts poor households in bad years. Overall, our results imply that the labor market effects of social transfers beget important additional benefits for the poor.

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1 Introduction

Social transfer programs have become increasingly common as a form of social protection for the poor across the developing world. The number of developing countries with social transfer programs has nearly doubled over the last two decades. Recent estimates suggest that social transfers cover over 2 billion people in developing countries and have helped 36 percent of the poorest escape poverty (World Bank, 2015, 2018). As social transfers expand in developing countries, it is crucial to understand their labor market effects, which could have important implications for their effectiveness and distributional impacts.

Theoretically, social transfers could reduce labor supply through an income effect or increase it through a health-productivity effect, but empirical evidence on either effect is scarce. Furthermore, there is little evidence on how possible changes in labor supply from social transfers affect wages and welfare. For instance, it is possible that a decrease in labor supply will drive up wages, improving the welfare of the poor who are typically net labor suppliers. This pro-poor effect could be particularly beneficial in years with negative economic shocks, when poor households rely on wage labor as a coping mechanism. It is thus possible that social transfers have large indirect poverty-reducing effects in addition to the direct effects of the transfers. Previous research has shown that wage effects can substantially increase the poverty-reducing effect of workfare program (Imbert and Papp, 2015; Berg et al., 2012). However, evidence for a similar effect of social transfers is lacking.

In this study, we examine the labor supply and wage effects of one of the world's largest social transfer programs - India's Public Distribution System (PDS). The PDS provides in-kind transfers of staple food to the poor at a highly subsidized price. The program is India's most important social program, providing assistance to over 800 million people and accounting for 60% of the social assistance budget. More broadly, in-kind transfers - particularly of food - are an important part of social transfers around the world. Approximately 1.5 billion people worldwide receive in-kind food transfers (World Bank, 2018), and about 44% of individuals covered by social programs receive in-kind transfers (World Bank, 2015). Despite their importance for developing country social programs, food transfers have received relatively little attention in the recent economics literature, which has predominantly focused on cash transfers and public works programs (Banerjee et al., 2017; Baird et al., 2018; Imbert and Papp, 2015)

Our empirical strategy exploits changes in PDS transfers that resulted from the National Food Security Act (NFSA) of 2013. Before this legislation, states had substantial discretion in setting the prices and quantities of PDS rations provided to program beneficiaries. This changed after the passage of the NFSA, which imposed national targets on all states. For instance, states were mandated to provide 5 kg per capita of staple grains to eligible households every month at prices no higher than 3 Rs/kg for rice and 2 Rs/kg for wheat. These entitlements were about 30% of the average monthly consumption of staple grains at 12% of the average market price in India. States whose pre-NFSA prices or quantities fell short of those targets had to expand their subsidies while states who were already in compliance did not. In addition, the NFSA mandated that states calculate PDS rations on a per-capita basis, allocating 5 kg of subsidized grain per eligible household member. Before the NFSA, some states had calculated rations on a per-household level, allocating a fixed amount of grain to each eligible household, regardless of

size. These states were forced to switch to a per-individual allocation, leading to more generous transfers for large household relative to small ones. As a result of these mandated changes, the NFSA generated substantial variation in PDS entitlements across state, time, household-size and PDS eligibility status.

We combine this policy variation with individual-level data from ICRISAT's "Village Dynamics in South Asia" panel (VDSA) between 2010 and 2015. Crucially for our study, the ICRISAT panel contains data on a household's size and the type of PDS ration card it possesses, as well as their monthly labor allocation. This allows us to generate a precise measure of the value of PDS transfers a household is entitled to receive at every point in time. To isolate the variation generated by the NFSA from discretionary state-level changes to PDS entitlements, we implement an instrumental variables approach based on counterfactual entitlements that would have existed if states had expanded PDS by the bare minimum needed to comply with the NFSA mandate. This variation lends itself well to estimating the causal effect of the transfer, since it was generated by a national rule and is therefore not likely correlated with changes in local policies or economic conditions. The fact that the changes to entitlements caused by the NFSA differed substantially across households in the same village allows us to estimate the effect of PDS transfers while controlling for a wide range of unobserved characteristics through individual, time and village-by-time fixed effects.

We find that increased transfers led to a moderate decrease in market labor supply and a larger increase in the equilibrium wage. A 100 rupee per household per month increase in the value of the transfer - equivalent to about 5% of household consumption and the average post-NFSA increase in entitlements in the state of Bihar - causes labor supply to decrease by 3.29% or 0.63 days per month. This reduction in labor supply causes daily wages to increase by 8.59% or 19.5 Rs per day. These estimates imply an elasticity of labor demand of 0.38, which is consistent with existing evidence (Imbert and Papp, 2015; Evenson and Binswanger, 1980). We show that the program's effect on wage leads to a redistribution of income from richer households, who are net labor buyers, to poorer households, who are net labor suppliers. The indirect benefits to the poor from increased wages are large relative to the direct effect of the transfer. For the poorest quintile the indirect welfare gains from the wage increase is about 5.4% of household consumption.

We then analyze the heterogeneous program impacts on the labor market. We find that the program effects are strongest for men in poor households working outside the household in the non-farm market, consistent with the notion that poor households use non-farm labor as a coping mechanism. Finally, we show that the program effects on labor supply and wages are particularly large during years with late monsoon onset, a rainfall shock associated with reduced agricultural production. This result suggests that social transfer programs can play an important role in preventing the vicious cycle of low wages and high labor supply that afflicts poor households in bad years.

Our paper makes three main contributions to the literature. First, it provides early evidence that social transfers reduce labor supply in developing countries. A small number of existing studies have found no evidence that transfers reduce labor supply in this context.[1] Most recently,

[1]Studies have found very small if any work disincentive effects of the United States' food stamp program

Banerjee et al. (2017) re-analyzed data from six randomized control trials of conditional cash transfers and found no statistical evidence for a reduction in labor supply. However, their results cannot rule out economically significant effects on labor supply. For instance, the 95% confidence interval of the effect of a cash transfer worth 10% of household consumption includes a labor supply reduction of 6%, which is comparable to the effect suggested by our estimates. Using a regression discontinuity framework, Bosch and Schady (2019) find no evidence that welfare payments reduce labor force participation in Ecuador. However, due to data limitations they are unable to test for an effect on days worked or other measures of the intensive margin of labor supply.

The unique nature of the VDSA data allows us to contribute to this literature by obtaining precise estimates of labor supply effects, including at the intensive margin. Most importantly, the VDSA collects monthly observations on the number of days worked, for a total of 60 observations per individual over a five year period. As pointed out by McKenzie (2012) an increase in the number of time periods in a panel dataset can lead to a substantial increase in the precision of estimates, especially for highly variable outcomes such as labor supply. This precision allows us to provide strong statistical evidence for a relatively modest labor supply effect of social transfers.[2]

As a second contribution, we provide novel evidence that social transfers can cause an increase in wages in the private sector. The indirect benefits to poor households that result from this wage increase are large relative to the direct benefits from the expansion of transfers. Previous studies have found evidence that workfare programs can increase private sector wages through substitution of labor between the public and private sector. Our results suggest that social transfers can cause similar wage effects by reducing poor households' reliance on wage income. Our results highlight the importance of accounting for local general equilibrium effects in program evaluation (Acemoglu, 2010). Ignoring general equilibrium effects on the labor market would lead us to underestimate the impact of the PDS program on the welfare of the poor.

Finally, we contribute to the literature on labor market dynamics in developing countries by showing that social transfers can stabilize wages against negative economic shocks. Previous studies have found that poor households rely on wage labor to smooth consumption during bad economic times (Kochar, 1999; Rose, 2001). The resulting increase in labor supply leads to a deterioration in wages precisely at times when the poor are most dependent on labor income (Jayachandran, 2006; Ito and Kurosaki, 2009). Our results suggest that social transfers can mitigate this vicious cycle of high labor supply and low wages by reducing the dependence of poor households on labor income as a coping mechanism.

(Hoynes and Schanzenbach, 2012; Currie, 2003; Fraker and Moffitt, 1988; Hagstrom, 1996). These results may not necessarily generalize to a developing country context, where poor households are much closer to subsistence levels and food makes up a large part of their total expenditure.

[2]It is possible that cash and in-kind transfers may not be equivalent with respect to their labor supply effects. Labor supply will necessarily be lower under in-kind, as compared to cash, if the in-kind transfer is infra-marginal and if there is strong complementarity between the in-kind good and leisure (Gahvari, 1994; Munro, 1989; Leonesio, 1988). While the issue of cash versus in-kind delivery of social transfers recently received considerable attention (Gentilini, 2016; Blattman et al., 2017), it is beyond the scope of this paper, since the absence of a cash-transfer program in India during our study period makes it impossible for us to compare the two modes of social transfer.

Our results inform the debate over the labor market effects of social transfers. Policy-makers have historically been concerned that social transfers decrease labor supply and that this may make them less effective at reducing poverty. While our results provide evidence that social transfers cause a modest reduction in labor supply, they show that the resulting increase in wages has substantial positive implications for poverty-reduction.

2 Institutional Background and Identifying Variation

The Indian Public Distribution System (PDS) is one of the largest social programs in the world, and the largest social program in India. The program accounts for almost 1% of the GDP (approx. 10 billion $US in 2016 Government of India (2017)). The PDS has been in existence since before India's independence. It was initially established as a rationing system by the British Government during World War II to ensure workers in a few urban centers received food (Nawani, 1994). In the early 1970s, the program evolved into a social program with the primary objective of providing food security to vulnerable households. Since then, the PDS has been the primary social program for food security in India.

In 1997, the Indian central government reformed the PDS from a universal system to a targeted program that supported the poor, using a system of household-level allocations based on ration cards. This system was expanded in 2002 and further reformed by the National Food Security Act (NFSA) in 2013. The PDS is jointly implemented and financed by center and state governments, detailed in the next section. We begin by describing the main features of the PDS system in the pre-NFSA period between 2002 and 2013, many of which remained in place after the NFSA. The subsequent section describes the major changes to the PDS system brought about by the NFSA, which form the basis of our identification strategy.

2.1 PDS before the National Food Security Act

The PDS is based on a system of ration cards that the government issues to households below the poverty line, which entitle them to receive a set quantity of food grains at a fixed price below the market price. There are two types of ration cards, Below Poverty Line (BPL) and Anthodaya Anna Yojanaa (AAY).[3] BPL cards are targeted to households below the poverty line, while AAY cards are reserved for the poorest among the BPL population who are disadvantaged in other ways, e.g. widows, disabled or elderly.

Ration cards are allocated through a two-step process involving central and state governments. First, the central government uses census data to determine the number of BPL and AAY households to be covered under the PDS in each state. State governments then use proxy means tests to allocate ration cards among their population. For example, during the pre-NFSA period 2002-2013, the central government estimated that the state of Bihar had 6.5 million households below the poverty line, out of which 2.5 million households were determined to be AAY. Accordingly, the state issued 4 million BPL cards and 2.5 million AAY cards based

[3]There is also a third type of ration card - Above poverty Line (APL) - for households above the poverty line. APL card holders in general do not receive any food grains and food allocation for APL households is on ad-hoc basis. We focus our attention on the ration cards that are entitled to receive PDS rations - BPL and AAY.

on a proxy means test that consisted of a series of exclusion restrictions (for example, households that owned more than five acres of land or an automobile were ineligible).[4]

Every year, the central government supplies state PDS systems with subsidized grain through an agency called the Food Corporation of India (FCI), which procures rice and wheat from farmers across the country and stores it in government-operated warehouses. The FCI offers grain to states at a uniform subsidized price called the central issue price, up to a maximum quantity that depends on the number of eligible households in the state. In the pre-NFSA period, the central issue price was 5.65 Rs./kg for rice and 4.15 Rs/kg for wheat for BPL households. The maximum quantity offered to a state was 35 kg of grain per month per household with a ration card.[5] The central issue price and quantity allocations from the center to state remained constant during the pre-NFSA period, for both BPL and AAY card holders.

State governments choose how much grain to buy from the FCI, up to the maximum offered quantity, and distribute it through a network of over 500,000 retail outlets known as fair price shops, each one serving a large village or a cluster of villages. With a fair price shop in almost every village in India, the PDS is the most far reaching of all social safety nets in the country.[6] At the fair price shop, beneficiaries with a ration card are allowed to purchase up to a fixed quantity of food grains at a fixed price, both set by the state government.

Before the NFSA, states had substantial discretion over the prices and quantities they offered to ration-card holders at PDS shops. The pre-NFSA variation in entitlements for BPL card holders across states is presented in Column A of Table (1).[7] A number of states chose to offer PDS grains at prices below the central issue price.[8] For instance, Jharkhand offered rice to BPL households at a price of 1 rupee per kg. The cost of this additional discount was borne by the state budget, since the revenues of the fair price shops were smaller than the outlays to the FCI. Moreover, states were also free to sell PDS grains at prices above the central issue price. For instance, pre-NFSA, the state of Bihar offered PDS rice to BPL households at a price of 7 Rupees per kg. Quantity entitlements of PDS grain also varied across states. As shown in Table 1, two states calculated entitlements at the individual level (Andhra Pradesh and Karnataka), while the rest calculated them at the household level. Furthermore, some states

[4]States had some flexibility in deciding the precise nature of the proxy means test used to allocate ration cards. For a more detailed account of ration card identification and allocation, see Saxena (2009)

[5]For example, since Bihar had 4 million households with BPL cards and 2.5 million with AAY cards, it was entitled to a monthly maximum of 87,500 metric tons of grain for AAY households at a price of 3 Rs/kg for rice and 2 Rs/kg for wheat (2.5 million AAY households 35 kg), and 140,000 metric tons for BPL households at 5.65 Rs./kg for rice and 4.15 Rs/kg for wheat (4 million BPL households 35 kg). States were also allowed to issue more ration cards and cover more beneficiaries than the number of households determined to be eligible by the center, by procuring additional food grains from sources other than the FCI. For instance, pre-NFSA, Andhra Pradesh issued 16.2 million BPL ration cards, compared to 4.1 million below poverty-line households identified by the center. Furthermore, some states such as Maharashtra and Orissa use fair price shops to provide food rations to households above the poverty line at a higher price, on an ad-hoc basis, based on the availability of food grains.

[6]In 2011, there were 506,198 PDS ration shops Government of India (2011b) in 597,608 inhabited villages Government of India (2011a). This suggests that as many as 85% of Indian villages were covered under the PDS. The coverage has since increased. In 2016, there were 532,000 FPs Government of India (2016)

[7]Information on state-level PDS policies before and after NFSA comes from personal fieldwork and government records. This information is not readily available in the public-domain. This paper is the first to systematically collect this information and document the policy changes after NFSA.

[8]This was only true for BPL households. For AAY households, the central government mandated that states had to sell the full allocation of 35 kg per household at a price no higher than the central issue price.

had substantially more generous entitlements than others. For example, Jharkhand allocated 35kg of PDS grain to BPL households, while Gujarat only allocated 18kg.

2.2 National Food Security Act

In 2013, the Indian central government passed the National Food Security Act (NFSA), which guaranteed a minimum quantity of food grains at affordable prices to every eligible person in India (NFSA, 2013). The NFSA, labelled as the biggest ever expansion of "right to food" in the world, converted the food grains provided through the PDS into a "legal entitlement" for beneficiaries (NFSA, 2013). As a commitment towards the NFSA, the central government increased the outlays on food subsidy by as much as 25% (or 230 billion rupees) from the previous fiscal year (Government of India, 2014) and substantially increased the generosity of PDS subsidies. The NFSA's main provision was to reduce the central issue price to 3 Rs/kg for rice and 2 Rs/kg for wheat, and to increase the quantity offered to states to 5 kg per eligible individual.

Crucially, the NFSA mandated the prices and quantities at which state governments had to provide PDS rations to beneficiaries - 5kg of food grains per person per month at a price not exceeding 3 Rs/kg for rice and 2 Rs/kg for wheat. This mandate essentially forced states to pass through central issue prices and quantities to beneficiaries. States that implemented NFSA no longer had the option of providing smaller quantities or selling at higher prices than the NFSA mandate. As a result, states whose pre-NFSA entitlements were less generous than the NFSA mandate had to expand their entitlements. States that found themselves already in compliance with the mandate, were free to keep their entitlements unchanged. Our empirical strategy exploits the variation generated by the forced compliance with the NFSA mandate.

Column B in Table 1 shows state-level PDS price and quantity entitlements for BPL card holders after the implementation of NFSA. One complication for our analysis is that the renewed political focus on food security made a number of states expand their PDS entitlements beyond the level necessary to comply with the mandate. These expansions were initiated during state-elections as part of election promises directed at the poor. For instance, the first executive decision by the Chief Minister of Karnataka in 2013 was to introduce Karnataka's own PDS program "Anna Bhagya Yojana", fulfilling an election promise of reducing the price of PDS rice to Rs 1/kg (Deccan Herald, 2013b). Similarly, the chief minister of Madhya Pradesh introduced the "Mukhyamantri Annapurna Scheme" as part of his election manifesto, and reduced the price for PDS rice to Rs. 1/kg (Deccan Herald, 2013a).

One concern is that these voluntary expansions that occurred during state elections could bias our estimates by introducing correlation between PDS entitlements and unobserved determinants of labor market behavior. To address this concern, we use an instrumental variables approach that uses the national NFSA mandate as an instrument for the state-level policies. In particular, we construct counterfactual entitlements that would have existed if every state had expanded PDS just enough to comply with NFSA mandates. Panel C shows the counterfactual entitlements based on minimum compliance with the mandate. In the following two sections, we explain the variation generated by the NFSA price and quantity mandates, and describe how we constructed counterfactual entitlements that isolate this variation.

2.2.1 Variation generated by the NFSA price mandate

Figure 1 shows time-series of the PDS rice prices offered to BPL households by the eight states in our data.[9] The left panel shows the actual PDS price entitlements and the right panel shows the counterfactual NFSA target price. As shown in the left panel, Pre-NFSA, states had substantial discretion over the prices offered to beneficiaries and a number of states offered prices above the central issue price. Post-NFSA, the center reduced the central issue price from 5.65 Rs./kg to 3 Rs/kg and mandated the states to offer PDS rice at Rs. 3/kg. As a result, states that were out of compliance were forced to bring down prices to comply with the NFSA mandate. For instance, the states of Bihar and Maharashtra reduced their prices from 7 Rs/kg and 6 Rs/kg to the mandated price of 3 Rs/kg. The figure shows that the price mandate was binding; by the beginning of 2014 all states had reduced their PDS rice prices to 3 Rs/kg or less.

Figure 1 also shows that most states that were already in compliance with the mandate continued with their existing entitlements. For instance, Jharkhand and Andhra Pradesh, whose PDS rice price was already below the new mandate at 1 Re/kg, left the price unchanged. An exception is the state of Karnataka, whose pre-NFSA rice price was Rs. 3/kg and was therefore already in compliance with the mandate. Nevertheless, Karnataka voluntarily reduced its PDS rice price to 1 Re/kg. The figure further shows that some states that were initially out of compliance with the mandate expanded their entitlements more than necessary to reach compliance. For instance, Madhya Pradesh reduced its PDS rice price from 4.5 Rs./kg to 1 Re/kg., even though a reduction to 3 Rs./kg would have sufficed to comply with the mandate.

As mentioned above, we are concerned that voluntary expansions of the type observed in Karnataka and Madhya Pradesh might be correlated with local economic shocks or other election-related changes. To address this concern, we use an instrumental variables approach that uses the national NFSA mandate as an instrument for the state-level policies. To isolate the variation generated by the price mandate, we construct counterfactual price entitlements that would have existed if every state had expanded PDS just enough to comply with the NFSA mandate. As shown in the right panel of Figure 1, we assume that states in compliance with the price mandate, such as Jharkhand and Andhra Pradesh, made no changes to PDS prices. We further assume that states that voluntarily lowered their prices beyond NFSA targets, such as Madhya Pradesh and Karnataka, only did the bare minimum to comply with the mandate. Finally, we assume that all states complied with the mandate in June 2013, when NFSA was officially enacted, ignoring state-level variation in the timing of the reform's implementation.

2.2.2 Variation generated by the NFSA quantity mandate

A second source of variation for our instrument comes from the NFSA's mandate that states provide at least 5kg of PDS grain per individual in eligible households. As shown in Table 1 Column A: Pre-NFSA, states followed different methods to calculate quantity entitlements. Some states, such as Andhra Pradesh and Karnataka offered PDS rations on a per-individual basis while imposing a maximum ceiling per household. Other states, such as Bihar and Maharashtra

[9] Similar expansions in PDS wheat price are reported in Table 1

offered PDS rations on a per-household basis, regardless of size.

As shown in Column A, five of the six states whose per capita quantity entitlement was initially below 5kg raised their entitlement to comply with the NFSA mandate of 5kg/individual. The exception is Gujarat, which brought its quantity entitlement in line with the NFSA mandate in 2016, after the end of our period of observation. The two states, Jharkhand and Orissa, whose quantity allocation already exceeded 5kg per capita, left their entitlements unchanged.

As with the price mandate, several states expanded their entitlements beyond the level necessary to comply with the NFSA mandate, specifically Karnataka and Andhra Pradesh. As before, we construct counterfactual PDS entitlements that ignore these voluntary expansions beyond the NFSA mandate. Thus we assume that states that voluntarily increased their quantity entitlements beyond the NFSA target level, such as Karnataka and Andhra Pradesh, instead did the bare minimum to reach compliance (Column B in Table 1). To construct these counterfactuals, we assume that all states changed their entitlement to 5 kg per individual. States whose entitlements were already above 5 kg are assumed to have left their entitlements unchanged.[10] An additional complication comes from the fact that the NFSA mandated 5 kg of grains per individual, but let states decide how this total would be split between rice and wheat. To calculate our counterfactual entitlements based on compliance with the NFSA mandate, we assume that states kept their proportional split between rice and wheat approximately constant as they expanded entitlements. For instance, Bihar's pre-NFSA entitlement was 15 kg/household of rice and 10 kg/household of wheat. We therefore assume that Bihar complied with the NFSA mandate by moving to a post-NFSA entitlement of 3 kg/individual of rice and 2 kg/individual of wheat. For details, see Table 1, which shows actual and counterfactual price and quantity entitlements for all states in our sample.

Figure 2 graphically displays how actual and counterfactual per capita quantity entitlements evolved over time. Similar to the price entitlements in Figure 1, states whose pre-NFSA quantity entitlements were initially out of compliance with the mandate expanded them more than states who were already in compliance. Note, however, that there is an additional source of variation created by the mandate that is not shown in Figure 2: the change in relative generosity of quantity entitlements for large and small households. The switch from household-level to individual-level allocation mandated by NFSA benefited large households relative to small ones. While this variation is not shown in Figure 2, we do take it into account when calculating household-level entitlements according to the entitlements shown in Table 1.

[10]Two states whose average per capita entitlements exceeded 5kg, calculated the entitlement per household, regardless of household size. These states therefore did not comply with the 5 kg per individual mandate for every household. For example, Jharkhand allocated 35 kg per household, so that a household of 8 would receive only 4.4 kg per individual. Nevertheless, the central government allowed these states to keep their entitlements unchanged, effectively treating them as in-compliance with the NFSA mandate. To test robustness to our definition of compliance with the mandate, we construct an alternative set of counterfactual entitlements, for which we assume that states whose pre-NFSA entitlement was above 5kg per capita were allowed to keep allocating their quantity entitlement at the household level. Estimates based on this counterfactual instrument are very similar to those of our baseline definition of compliance.

3 Data and Empirical Strategy

We use the new wave of ICRISAT's panel study Village Dynamics in South Asia (VDSA). These data contain information on 1300 households with 6000 individuals observed over 60 months from June 2010 to July 2015. The VDSA data cover 30 villages spread across eight states in India: Andhra Pradesh[11], Bihar, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra and Orissa; with 4 villages in each state, except Madhya Pradesh with only 2 villages. The VDSA panel data are geographically divided into 18 villages in the Semi-Arid Tropics (SAT) and 12 villages in the Eastern region of India. The locations of the villages are shown in Appendix figure A4. All the 30 villages have a PDS fair price shop.[12] Households in each village are randomly selected to represent households in four land-holding classes: large, medium, small and landless.

To construct our main outcome variables, we use individual-level data on labor supply and earnings collected every month and individual characteristics such as age and gender collected annually. To identify beneficiary households, we use the ration card status of each household at baseline in 2009. For our estimations, we also use household-level data on rice and wheat consumption and village-level data on rice and wheat prices, collected on a monthly basis. Summary statistics are presented in Table 2.

Rainfall data are from the Indian Meteorological Department, defined at a fine spatial resolution of a 0.25 x 0.25 grid cell size. Daily rainfall data for the ICRISAT villages are obtained by mapping the village co-ordinates to each grid cell polygon. No two villages fall within the same grid cell and hence our rainfall measure varies by village. In this study, we consider monsoon onset as a measure for rainfall shock. Following Rosenzweig and Binswanger (1993), we define the first day of the monsoon as the first day after June 1st with more than 20 mm of rain on one day, and define the monsoon onset variable as the number of days between June 1st and the first day of the monsoon.

3.1 Measuring PDS transfer size

Following Kochar (2005) and Kaul (2018), we quantify the generosity of the PDS transfer by calculating the product of quantity entitlement and price discount (difference between the market and PDS price):[13]

$$T_{hst} = \overbrace{Q_{hst}^{pds\,rice}\left[\overline{P}_{s}^{Market\,rice} - P_{hst}^{pds\,rice}\right]}^{Rice} + \overbrace{Q_{hst}^{pds\,wheat}\left[\overline{P}_{s}^{Market\,wheat} - P_{hst}^{pds\,wheat}\right]}^{Wheat} \quad (1)$$

[11]Two villages are in Telangana, a state formed in 2014. As our dataset begins before the formation of the new state, and for the purpose of consistency, the 2 villages in Telangana are considered as Andhra Pradesh

[12]The corresponding author of this study visited most of these SAT villages in person and conducted extensive fieldwork. The operation of PDS ration shops in each village, validation of ration card status and perception of PDS among beneficiaries were all documented.

[13]Measuring the generosity of PDS subsidies in terms of their implicit transfer value is valid if the subsidized amount is infra-marginal, so that consumption of staple cereals is more than what is provided by the PDS. Our data suggests that this is generally the case for households in our sample. The average household in our data consumes 48kg of staple cereals as compared to a maximum of 35kg of grains per household provided by the PDS. None of the households get all their staple cereals from the PDS in a given month.

where Q_{hst}^{pds} and P_{hst}^{pds} are the PDS quantity and price entitlements for household h in state s in month t. As described in Section 2, these entitlements are a function of the household's state of residence, ration card status and household size. For each household, we calculate two versions of the transfer value T_{hst}: one based on actual state-level PDS policy at time t, the other based on a counterfactual scenario to isolate the variation induced by the NFSA reform that assumes that in June 2013, each state only expanded PDS entitlements by the minimum amount needed to comply with NFSA mandates. This counterfactual scenario thus ignores voluntary state-level expansions of PDS and differences in the timing of NFSA reforms, to address the concern that these factors may be correlated with unobserved state-level shocks.

To address the concern that household characteristics may be affected by state-level PDS reforms or unobserved shocks, we calculate Q_{hst}^{pds} and P_{hst}^{pds} using only household characteristics measured at baseline: household's ration card status in 2010 and average household size in 2010-12. Finally, we define the market price, $\overline{P}_{s}^{Market}$, as the average market price in state s before 2013, to avoid endogeneity between market prices and NFSA reforms.[14] Price data come from the Price Schedule in the ICRISAT data and correspond to a comparable variety of PDS rice and wheat. We deflate the PDS transfer value to 2010 Indian rupees. We deflate the PDS transfer value to 2010 Indian rupees.

Figure 3 compares our measures of T_{hst} based on actual state policy (left panel) and counterfactual NFSA target policy for a household of six people with a Below Poverty Line ration card. For example, in Bihar before the NFSA reform, this household received 15 kg of rice at 7 Rs./kg and 10kg of wheat at 5 Rs./kg. Market prices were 23 Rs/kg for rice and 14 Rs/kg for wheat, which yields a price discount of 16 Rs/kg for rice and 9 Rs/kg for wheat and a transfer value of Rs.330 (T_{hst}=1516+109). After the NFSA, the same household received 18kg of rice at 3 Rs./kg and 12kg of wheat at 2 Rs./kg, adding up to a transfer value of Rs.504 (T_{hst}=1820+1212). Figure 3 shows that there is substantial variation in PDS transfers across states and over time, and that there is strong correlation between actual and counterfactual entitlement values.

3.2 Estimating equation

We examine the program impacts on labor supply and wages using the following estimating equation:

$$Y_{ihst} = \alpha_i + \lambda_t + \delta_s t + \beta_1 T_{hst} + \epsilon_{ihst} \tag{2}$$

Y_{ihst} is the outcome (labor supply or wages) for individual i in household h, state s, and month t. T_{hst} is the household's PDS transfer value, α_i and λ_t are individual and month fixed effects, and δ_s are state-specific linear time-trends. Standard errors are clustered at the village level. Labor supply is measured as the number of days worked in a month, wages are measured as daily wages in rupees per day. The PDS transfer value T_{hst} is instrumented with its target value based on the NFSA mandates. For labor supply, we use the full sample of individuals and for wages, we use the sample of individuals reporting participation in the labor market.

[14] Previous studies have shown that food transfers can lower local consumer prices (Cunha et al., 2011). It is therefore possible that an expansion of the PDS transfer leads to a decrease in market prices, since PDS and non-PDS grains are close substitutes, which would bias estimates based on post-expansion market prices

4 Results

4.1 Transfers reach beneficiaries

We begin by validating that the mandates of the NFSA reform were implemented by the states and that state-level PDS entitlements were in fact available to households. The results of this exercise are presented in Table 3. Panel A shows the estimated effects of NFSA targets on actual PDS entitlements. Actual entitlements were calculated as described in the previous section, by combining baseline household size and ration card status with the current PDS policies of the household's state of residence. NFSA target values were calculated as described in Section 2.2, assuming that all states expanded PDS entitlements just enough to comply with NFSA mandates.

The estimates in Panel A show that states largely implemented the NFSA's mandates. A one kg increase in the NFSA quantity target increases a household's actual entitlement by 0.87 kg. Similarly, a one Rupee/kg decrease in the NFSA target price reduces the household's PDS price entitlement by 0.69 Rupee/kg. Taking price and quantity entitlements together as described in the previous section, a one Rupee increase in the value of the NFSA target increases the actual entitlement value by 0.78 Rupees. The relationship between NFSA target value and actual PDS entitlement is strong, with an F-stat above 200, which allows us to use NFSA targets as an instrumental variable for actual entitlements.

Panel B shows estimates of the effects of changes in PDS entitlements on actual consumption of grains from PDS fair price shops, based on data from the ICRISAT panel. The results show that changes in state-level PDS policies were largely passed through to beneficiaries. A one kg increase in a household's PDS entitlement led to a 0.53 kg increase in consumption of PDS grains. A one Rupee/kg decrease in a household's price entitlement reduced the household's purchase price of PDS grains by 0.7 Rupees/kg. Finally, a one Rupee increase in the value of a household's entitlement led to a 0.55 Rupees increase in the value of the realized PDS transfer, calculated as the difference between the cost of the household's consumption of PDS grain and the value of the same quantity of grain at current market prices. Thus, while our results suggest that leakage may exist and be substantial, beneficiary households did capture some of the increase in entitlements.

Finally, Panel C shows the effect of NFSA targets on actual consumption of PDS grain. As before, the results show that the NFSA targets reached beneficiaries. A one kg increase in the NFSA target led to a 0.4 kg increase in consumption of PDS grains. A one Rupee/kg decrease in the NFSA target price reduced the household's purchase price of PDS grains by 0.48 Rupees/kg. A one Rupee increase in the value of the NFSA target led to a 0.35 Rupees increase in the value of the realized PDS transfer.

Overall, these results show that the NFSA mandates generated substantial variation in state-level PDS policies, as well as household-level PDS entitlements and consumption, which allows us to use the mandates as instrumental variables.

4.2 Labor market effects

We examine the labor market effects of PDS transfers by estimating equation (2). Table 4 reports estimates of the effects on market labor supply for the full sample of individuals. The results show that a more generous PDS transfer value decreases labor supply. Based on the co-efficient estimates in Column (1), a one rupee increase in PDS transfer value translates to a 0.0063 days per month decrease in individual labor supplied to the market. Results are robust to controlling for village-specific linear time-trends (Column 2), and state-specific seasonal month fixed effects (Column 3). Furthermore, the significance of the results remain similar with standard errors clustered at the state level (Column 4).

To interpret the economic significance of the estimate, we consider a policy experiment of increasing the PDS transfer value by 100 rupees per household per month - an amount equivalent to the PDS expansion in Bihar and about 5% of monthly consumption expenditure for a BPL household. Based on the coefficient estimates in column (1), a 100 rupees increase in PDS transfer value translates to a bit over half a day per month decrease (0.63 =1000.0063) in individual labor supplied to the market. In comparison to the sample mean of 18.9 days, the expansion of the PDS program decreases the total individual labor supply by 3.29% (=0.63/18.9).

Table 5 reports estimates of the effect of PDS transfers on wages. The results show that a more generous PDS transfer increases the equilibrium wage. Based on the coefficient estimates in Column (1), a one rupee increase in PDS transfer increases daily market wages by 0.20 Rs/ day. Columns 2 and 3 show that the wage effect results are robust to the inclusion of more fixed effects. For a PDS program expansion as in Bihar, the results suggest that a 100 rupees per household increase in PDS transfer value increases daily market wages by approximately Rs 19.5 (=1000.195) or 8.59% of the sample mean. This effect is similar in magnitude to estimates from other safety-net programs in India. A comparison to the market-wage effect of NREGS, India's public work fare program, shows that our estimate is slightly lower than the estimated 8.9% market-wage increase from the roll-out of NREGS (Imbert and Papp, 2015) and slightly higher than the estimated 6% market-wage increase from improving the implementation of NREGS (Muralidharan et al., 2017).

Our results are consistent with a labor demand elasticity toward the higher end of the range of estimates found in the previous literature. Our estimates above suggest that a 100 Rupees increase in PDS transfers, decreased labor supply by 3.29% and increased wages by 8.59%. Hence, the elasticity of labor demand is $\tilde{\epsilon_d} = \frac{1.7}{4.4} \approx 0.38$, which is only slightly higher than the 0.31 estimated by Imbert and Papp (2015) and lies within the range of 0.25 to 0.4 estimated by Evenson and Binswanger (1980) for farm employment in India. Our estimates reflect the elasticity over the relatively short-run, since the period of observation ends two and a half years after the NFSA was passed. The long-run elasticity of labor demand is likely to be higher, so that wage effects may decrease over time.

4.3 Robustness tests

Our empirical strategy is based on the identifying assumption that the labor market outcomes of households whose PDS entitlements increased as a result of NFSA were on parallel trends to the outcomes of households whose entitlements decreased or remained unchanged. The

assumption would be violated if these groups of households had systematically different time-trends, or were subject to unobserved shocks that coincide with the implementation of NFSA. We conduct several robustness tests for this identifying assumption.

First, we test for differential pre-existing trends by including a one-year lead of the PDS transfer in our regression.[15] The results, presented in Tables 6 and 7 show that the coefficient associated with the lead is small in magnitude and statistically insignificant. We thus find no evidence that the labor market outcomes of households whose entitlements were differently affected by NFSA followed different trends before the NFSA.

Next, we estimate regressions that control for state-by-time and village-by-time fixed effects, to test whether our results are biased by geographically clustered time-varying unobserved shocks. The most restrictive of these estimates are based on comparing the labor market outcomes of households that were differently affected by NFSA reforms in the same village in the same year. Local economic shocks, such as changes in labor demand, local climate, or macroeconomic shocks to locally prevalent sectors are absorbed by the fixed effects, as are changes to state-level policies. These regressions are akin to a triple-differences approach, in which households whose entitlements were unaffected by the NFSA, perhaps because they do not own a PDS ration card, serve as a within-village control group. The estimates, reported in Table 8, are very similar to those of our baseline specifications, which suggests that our results are not driven by unobserved time-varying shocks that operate at the state or village level.

One concern about this triple-differences approach is that there may be spillovers between PDS beneficiaries and non-beneficiaries. For example, it is possible that increased access to subsidized PDS grains drives down the price of non-subsidized grain through market competition. This would also benefit households without ration cards, who might therefore also reduce their labor supply. Furthermore, a reduction in labor supply of PDS beneficiaries is likely to lead to an increase in wages of non-beneficiaries who compete in the same labor market. If this is the case, estimates from a triple-difference approach that uses non-beneficiaries as an internal control would be biased downward. To explore this concern, Table 9 presents regressions that restricts the sample to PDS beneficiaries (households with either a BPL or an AAY card). The estimates are very similar to those from the whole sample. While the point estimate for labor supply is slightly larger for the beneficiaries-only sample, the wider confidence interval does not allow us to rule out that the effects are the same across samples, suggesting that spillovers are of limited magnitude.

Finally, we validate that our main results on the labor market outcomes from increases in PDS entitlements as a result of NFSA reforms were not confounded by changes in other government welfare programs. First, we test whether our results are robust to controlling for state-level NREGA policy changes that may have differentially affected BPL households. Specifically, we estimate equation (2) controlling for an interaction term of ration card status of households and changes in state-level NREGA fiscal allocation and implementation. The estimates, reported in Table 10, are qualitatively similar to our base specification, which suggests that our results are not driven by policy changes in NREGA. Furthermore, we also test for any confounding effects

[15] As with the contemporaneous transfer value, we instrument the lead with a counterfactual entitlement based on the NFSA target mandates. However, to instrument the lead, we calculate entitlements based on a counterfactual in which the NFSA was passed in June 2012, one year before it was actually passed.

with other government welfare programs including Midday meals, Pensions, Scholarships and relief loans. In particular, we estimate the effect of households' PDS entitlement on the benefit values received by the same household from welfare programs, in a regression that controls for household and time fixed effects. The estimates, reported in Table 11 are small and statistically insignificant. We thus find no evidence that increases in PDS entitlements from NFSA for the beneficiary households in our data were associated with the receipt of benefits from other welfare schemes received by the same households.

4.4 Heterogeneity analysis

Our main specification focused on the program effects on the labor market, where we measured market labor as labor outside the household. The program could have important differential impacts by market segment or by gender, and could also influence labor supply within the household. In this section we take a closer look at the heterogeneous impacts of the program to shed light on the possible mechanisms through which the program may affect individual labor supply and wages.

Table 12 reports the program effects on labor supply separately for inside and outside the household. We find that the PDS program has no effect on self-employment or work within the household and an insignificant effect on individuals' total labor supply. These results show that the program exclusively impacts outside work or labor supplied to the market.

Next, we focus on heterogeneous effects within the labor market. Table 13 reports the program impacts on labor supply and wages, segregated by market segment (Column B) and by gender (Column C). Column B separately reports estimates in the farm and non-farm sectors. These results show that the program effect is concentrated on the non-farm labor market. The fact that PDS transfers increase farm wages even though they do not affect labor supply is most likely due to substitution across sectors. Farm and non-farm local labor markets are at least partially integrated, so that a decrease in supply of one market leads to an increase in wages in the other. Column C reports the program effects separately for men and women. These results show a stronger effect for men and an insignificant effect for women.

Furthermore, we validate the results on heterogeneous results on the labor market, by examining the differential impacts on labor supply based on the individual's occupation. These results, reported in Table 14 show that the labor supply reduction from the program is stronger for individuals who are primarily engaged in non-farm and farm labor. We find no significant effect on individuals engaged in domestic work, business or have a salaried job. These results are consistent with previous results of a stronger effect on the non-farm labor market.

Last, we validate that the labor market effects documented above are driven by the changes in labor supply of poorer households, who in principal are the target beneficiaries of the PDS program. Table 15 reports the labor supply effects, segregated by landholding size, expenditure quintile and caste group in Columns A, B and C, respectively. These results show that the program effects are concentrated for individuals who are landless or small farmers, fall in the bottom two expenditure quintiles or belong to the lower caste groups. These results suggest that program primarily impacts the market labor supply of poorer than average households.

Overall, the heterogeneity estimations suggest that the program effect is concentrated for

men in poor households working in the non-farm market. Our results are consistent with existing evidence that poor households use non-farm income as a coping strategy (Barrett et al., 2001; Ellis, 1998). Since non-farm labor supply is typically the residual labor supply, and therefore more elastic than the supply of farm labor, we would expect that an increase in social transfers will lead households to reduce the former more than the latter. Further, this finding suggests that despite being an in-kind food transfer which reduces the effective price of staples, farmers are not reducing their labor that goes to produce food. Thus, farm households are treating this program as a safety-net that increases effective income, not purely as a food transfer.

4.5 Wage stability against productivity shocks

Wages in poor and underdeveloped regions, respond strongly to fluctuations in agricultural productivity, caused for example by rainfall shocks. Bad rainfall may result in lower crop yield, reducing the demand for labor at harvest time and thereby depressing wages, with severe welfare consequences for the poor. The negative welfare effects of agricultural productivity shocks are particularly strong for the poorest, who rely on wage labor as an income smoothing strategy. Previous studies have shown that the poor increase their market labor supply in response to agricultural shocks, to make up for lost income from agricultural production (Kochar, 1999). This increase in labor supply causes wages to deteriorate, which further increases the poor's need to generate income, leading to a vicious cycle of high labor supply and low wages (Jayachandran, 2006). A safety-net like the PDS could mitigate this vicious cycle by reducing the need to generate income in response to productivity shocks. In this case, we would expect the effect of PDS on labor supply and wages to be particularly large in years with a negative productivity shock.

We test this proposition by considering rainfall as a measure of productivity risk. The ICRISAT villages provide a unique setting to test this proposition, where a majority of households are vulnerable to rainfall shocks (Gine, 2007; Jacoby and Skoufias, 1997; **?**). Following (Rosenzweig and Binswanger, 1993), we use the timing of monsoon onset as a rainfall-based productivity shock. This timing is a crucial predictor of agricultural profits, since the early monsoon provides the soil moisture necessary for the initial stages of plant growth. Previous work has shown that agricultural yields and profits are lower in years with a late monsoon onset (Rosenzweig and Binswanger, 1993).

We estimate whether the PDS has greater labor market effects during negative shocks, by considering the interaction between PDS transfer and monsoon onset:

$$Y_{ihst} = \alpha_i + \lambda_t + \delta_s t + \beta_1 R_{vy} + \beta_2 T_{hst} + \beta_3 R_{vy} T_{vst} + \epsilon_{ivt} \tag{3}$$

Y_{ihst} is the outcome (labor supply or wages) for individual i in household h, state s, and month t, T_{hst} is the household's PDS transfer value,R_{vy} is the number of days that monsoon onset occurred after June 1 in village v in crop-year y,[16] α_i and λ_t are individual and month fixed effects, and δ_s are state-specific linear time-trends. The PDS transfer value T_{hst} is instrumented

[16]Following (Rosenzweig and Binswanger, 1993), we define the date of monsoon onset as the first day after June 1 with more than 20 mm of rain. In our data, this measure of monsoon onset is highly correlated with alternative rainfall measures and with village crop yields, production and price in our data.

with its target value based on the NFSA mandates. Crop-year y is defined from September to August, as the effect of monsoon (or harvest season) in India commences from September.[17] The co-efficient on the interaction term β_3 reflects the difference in the effect of PDS expansion between years with more and less favorable rainfall. Standard errors are clustered at the village level.

The results of this estimation, reported in Table 16, show that late monsoon increases labor supply and decreases wages, while a more generous PDS transfer reduces labor supply and increases wages. The interaction terms suggest that PDS transfers decrease labor supply and increase wages more strongly in years with negative rainfall shocks. The wage estimates suggest that a one rupee increase in PDS transfer when monsoon onset is delayed by 10 days (or at the 25th percentile of monsoon shock) increases wages by 0.199 Rs/day (=0.193 + 0.006), whereas the wage increases by 0.24 Rs/day (=0.193 + 0.05) when monsoon is delayed by 70 days (or at the 95th percentile of monsoon shock). For a PDS program expansion, as in Bihar, the same estimates imply that, a 100 rupees per household per month increase in PDS transfer value increases wages by 19.9 Rs/day (=0.199100) when the monsoon is delayed by 10 days, whereas the wage increases by 24 Rs/day (=0.24100) when the monsoon is delayed by 70 days. While these effects are modest, the results suggest that PDS transfers help stabilize labor markets against the vicious cycle of high labor supply and low wages that occurs in years with negative productivity shocks.

We further explore the seasonality of this stabilizing effect by including interactions with seasonal dummies. Results reported in Table 17 show that the wage stabilization effect of PDS is concentrated during the lean season. This finding is consistent with a mechanism in which poor households use the market labor in the lean season to make up for lower agricultural productivity and incomes during the agricultural season. Since labor demand is lower in the lean season, this reduced labor supply would have a particularly large effect on wages. Thus, our results suggest that the effect of PDS transfers on wages is largest during bad agricultural years during the lean period, exactly when poor households most rely on market labor income.

Overall, our results imply that increases in the generosity of the PDS transfers are effective in moderating the impact of negative economic shocks on labor market outcomes. These results are consistent with the findings in Jayachandran (2006), that productivity shocks cause larger changes to labor supply and wages if workers are closer to subsistence level because such workers supply labor less elastically. A safety net like the PDS can relax the subsistence constraint and thus make labor market outcomes less sensitive to production shocks.

5 Distributional Impact

The previous analysis suggests that the expansion of PDS transfers after the NFSA reforms led to an increase in wages, which benefits net labor sellers and hurts net labor buyers. Since net labor sellers are likely to be poorer than net labor buyers, this effect is likely to have pro-poor distributional impacts. We estimate the distributional impact of the wage effect in terms of household welfare for different consumption quintiles.

[17] For instance, monsoon onset in 2013 would correspond to monthly labor supply from September 2013 to August 2014.

Following Imbert and Papp (2015), we calculate the welfare effect of an equilibrium wage increase from the PDS program in terms of compensating variation or the income needed to compensate households for a policy change

$$\text{Welfare gain}_i = (\text{Net labor earnings})_i * \frac{dW/W}{dT} \tag{4}$$

The welfare gains for different consumption quintiles are reported, step-by-step, in Table 18. The first term on the right-hand side of eq.(4) is estimated using the available data in the ICRISAT panel on total labor earnings from the Employment Schedule and total labor payments to hired laborers from the Cultivation Schedule. Estimates of total labor earnings and total labor payments/costs by consumption quintile are reported in Rows (3) and (5) in Table 18. Net labor earnings (Row 6) are calculated as the difference between total labor earnings and total labor costs (Row 3 - Row 5). As households in the poorest quintile are net suppliers of labor, the net labor earnings is the highest for the poorest quintile and decreases for higher quintiles. The second term $\frac{dW/W}{dT}$ in equation (4), which represents the equilibrium wage change due to a change in PDS transfer value, is estimated to be 8.6%, based on the estimated 19.5 Rupees increase in wages brought about by a 100 Rupees increase in PDS transfer value, as reported in Table 18. The resulting net welfare gain from the wage change is 8.6% multiplied by net labor earnings for each quintile.

As PDS is a targeted program, the poorer quintiles receive larger benefits (Rows 10 and 11). Households in the richest quintile also receive a modest amount from the PDS, probably due to inclusion errors in targeting. In our data, about 73% of households in the poorest quintile and 33% of households in the richest quintile hold a BPL ration card (Row 9). The extent of inclusion and exclusion errors in ration card allocation has been widely discussed and highlighted (For example, see Dreze and Khera (2010) and Niehaus et al. (2013)). We assume that the direct gains from a 100 rupees increase in PDS transfer follows the same distribution as the proportion of households receiving the transfer.

The total gain is then computed as the sum of direct gains from the PDS program and the indirect gains from the wage change (Row 8 + Row 12). Figure depicts the estimated total welfare gain levels as a fraction of household consumption, Rows 15-17 in Table 18. The figure shows that the gains for the poorest quintile is about 8.8% of household consumption. The indirect gains through the wage channel are highest for households in the poorest quintile, since these are the largest sellers of labor. This indirect effect from the wage change increases the welfare benefit for the poorest quintile by an additional 62% (Row 14). In contrast, for households in the richest quintile who are net labor buyers, the increase in labor costs result in a welfare loss. However, the welfare loss for the richest quintile, expressed as a fraction of total expenditure, is only around one percent of total expenditures (Row 17).

The analysis in Section 5.3 suggests the equilibrium wage increase due to an expansion in the PDS program is greater in years with a negative monsoon shock, especially in the lean season. In order to measure the distribution of welfare gains for different intensities of rainfall shocks, we simulate the effect of PDS transfer value on equilibrium wages for different values of monsoon onset, based on the coefficient estimates in Table 16. These predicted marginal effects and the corresponding welfare gains at the 25th and 95th percentile of rainfall shock are reported

in Rows 18-21 and Rows 22-25 respectively. The numerical estimates, also depicted in a bar graph in Figure 5, show that the welfare gains from the wage increase is not only highest for the poorest quintile, the gains are also greatest when households face a large negative monsoon shock.

In summary, the distributional impact analysis suggests that the equilibrium effects of the PDS program on the labor market are significantly welfare improving for poor households, especially the poorest quintile.

6 Conclusion

The ongoing expansion of social transfers in developing countries could have important implications for labor markets that are not well understood. Our results suggest that an expansion of in-kind food transfers in India led to a modest reduction in labor supply and a substantial increase in low-skilled wages. This wage increase had important distributional effects, redistributing income from the rich, who are net buyers of labor, to the poor who are net sellers. This result highlights the importance of accounting for local general equilibrium effects when assessing the welfare effects of social transfers (Acemoglu, 2010). We further find that the effect of social transfers on labor supply and wages is strongest in years with bad productivity shocks and specifically during the lean season. This result is consistent with a mechanism in which social transfers reduce the dependence of the poor on labor income as a coping mechanism. Because of this, social transfers can help break the vicious cycle of high labor supply and low wages that afflicts the poor in bad economic times.

Overall, our results imply that their labor market effects make social transfers more effective at protecting the poor. In the public discourse, the possibility that social transfers reduce labor supply has often been framed in negative terms. For instance, politicians have historically been concerned that social transfers may make recipients "lazy" (Madras High Court, quoted in the Telegraph India (2018)) and hence may have little impact on the welfare of the poor. Our results suggest that this is not the case. While social transfer programs may cause a modest reduction in labor supply, the resulting increase in wages substantially increases their effectiveness for poverty-reduction.

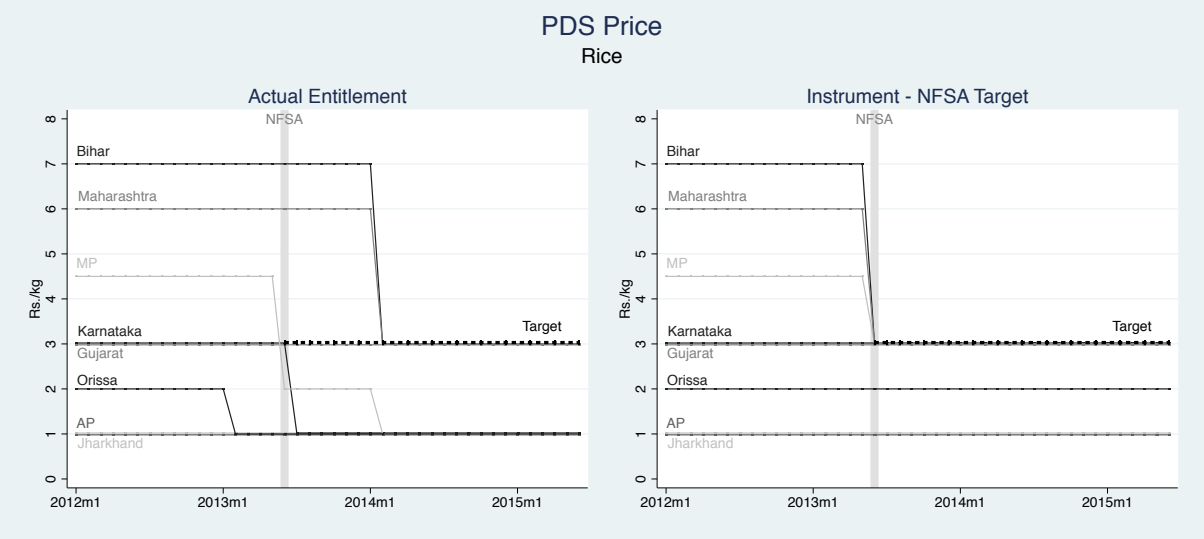

Figure 1: Variation in PDS Rice price: Actual entitlement (left) Counterfactual NFSA target (instrument)

Notes: Vertical lines denote PDS Rice prices in Rs./kg for BPL households in the eights states in the ICRISAT panel. Dashed vertical line denotes NFSA target price. Horizontal shaded line denotes NFSA enactment.
Source: Information on state-level PDS entitlements (left panel) comes from author's fieldwork and government records. The NFSA target (right panel) is based on the counterfactual scenario that assumes that in June 2013 each state only expanded by the minimum amount needed to comply with NFSA price mandate.

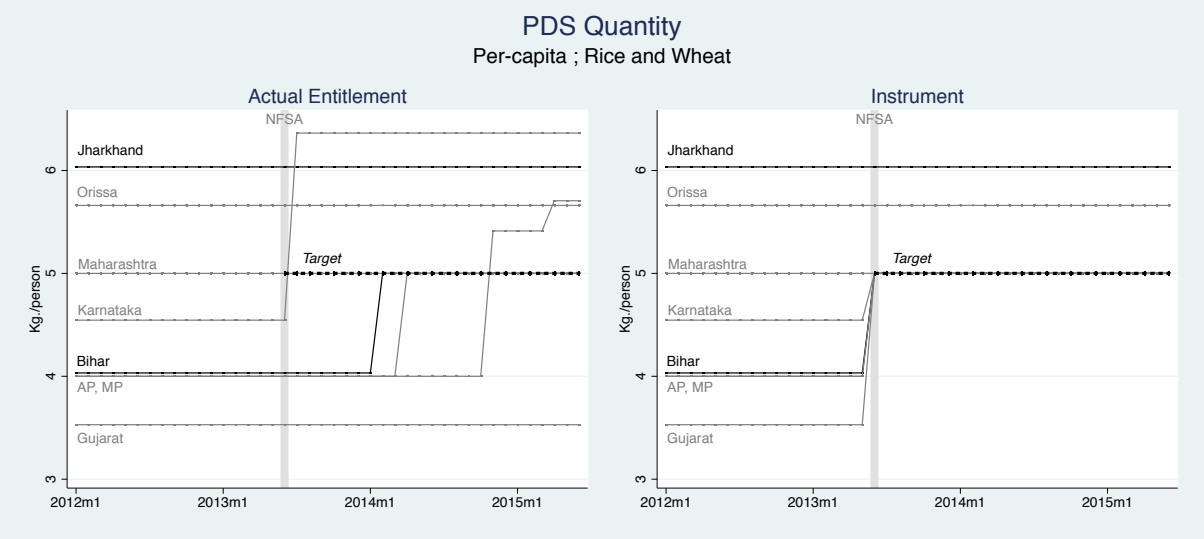

Figure 2: Variation in PDS Quantity: Actual entitlement (left) Counterfactual NFSA target (instrument)

Notes: Vertical lines denote PDS quantity in Kg./person for BPL households in the eights states in the ICRISAT panel. Dashed vertical line denotes NFSA target quantity. Horizontal shaded line denotes NFSA enactment.
Source: Information on state-level PDS entitlements (left panel) comes from author's fieldwork and government records. The NFSA target (right panel) is based on the counterfactual scenario that assumes that in June 2013 each state only expanded by the minimum amount needed to comply with NFSA quantity mandate.

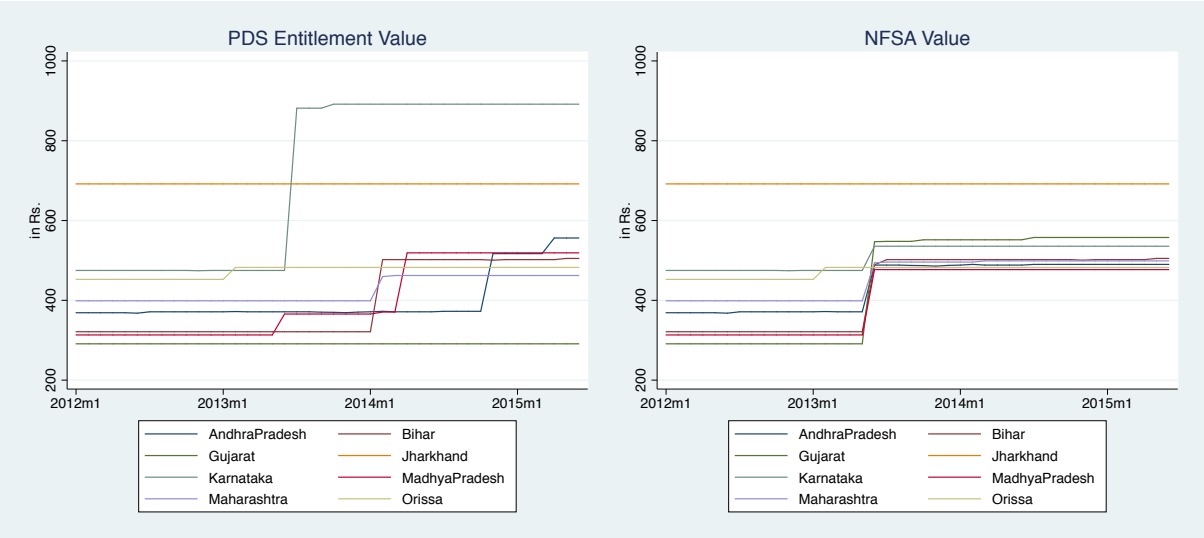

Figure 3: Variation in PDS Transfer : Actual entitlement (left) Counterfactual NFSA target (instrument)

Notes: Vertical lines denote PDS transfer value in Rupees for BPL households in the eights states in the ICRISAT panel

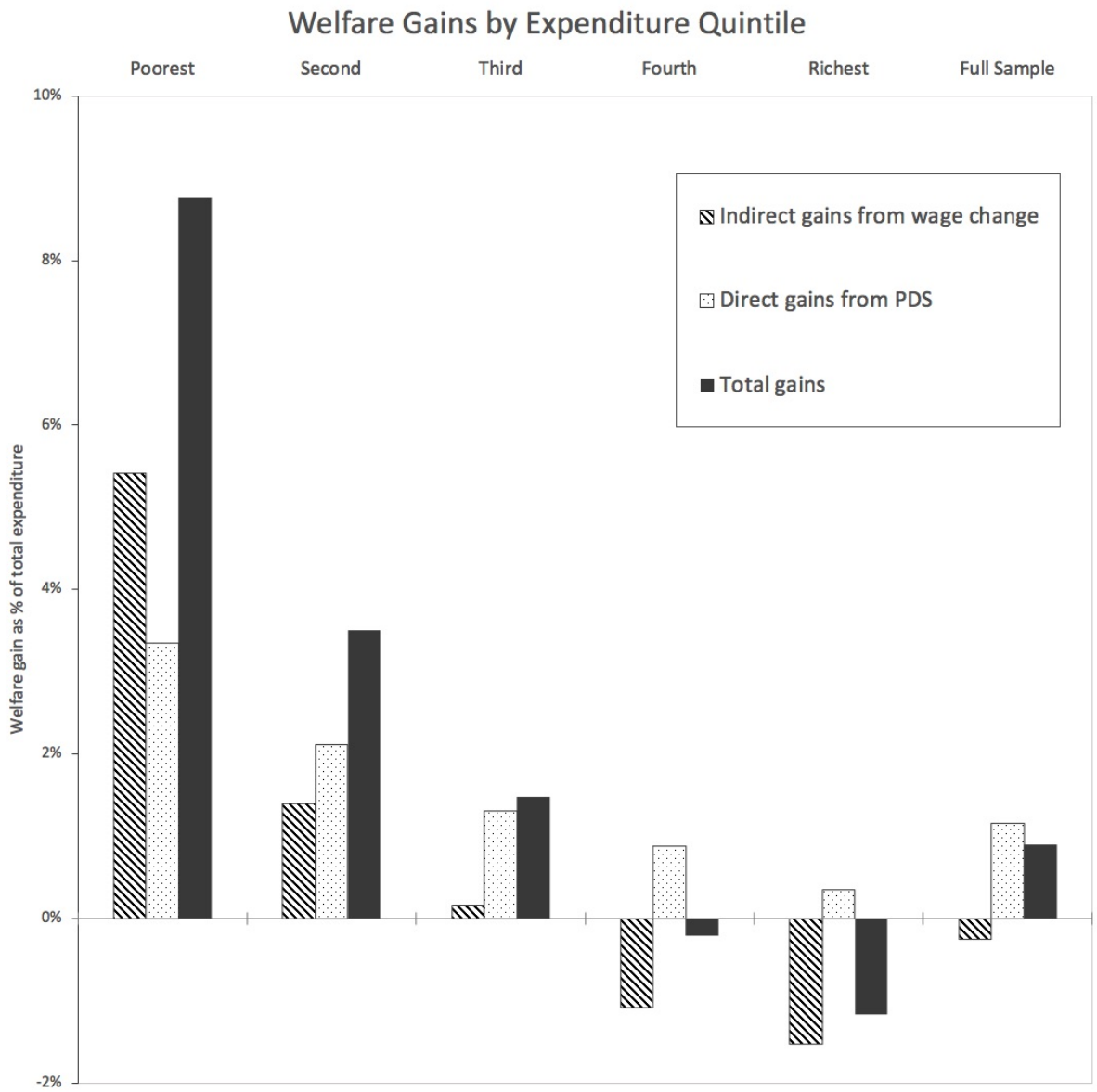

Figure 4: Indirect and Direct welfare gains by expenditure quintiles

Notes: Welfare gains are expressed as a fraction of household consumption expenditure per month. Indirect gain from wage change is obtained by multiplying the average net casual labor earnings in each consumption quintile by the wage increase estimated in Table 5. Direct gain from the PDS program is based on a 100 rupees increase in transfer value equivalent to the PDS expansion in Bihar. We assume that the direct gains follow the same distribution as the proportion of households in each quintile receiving the transfer. See Table 18 for more details.

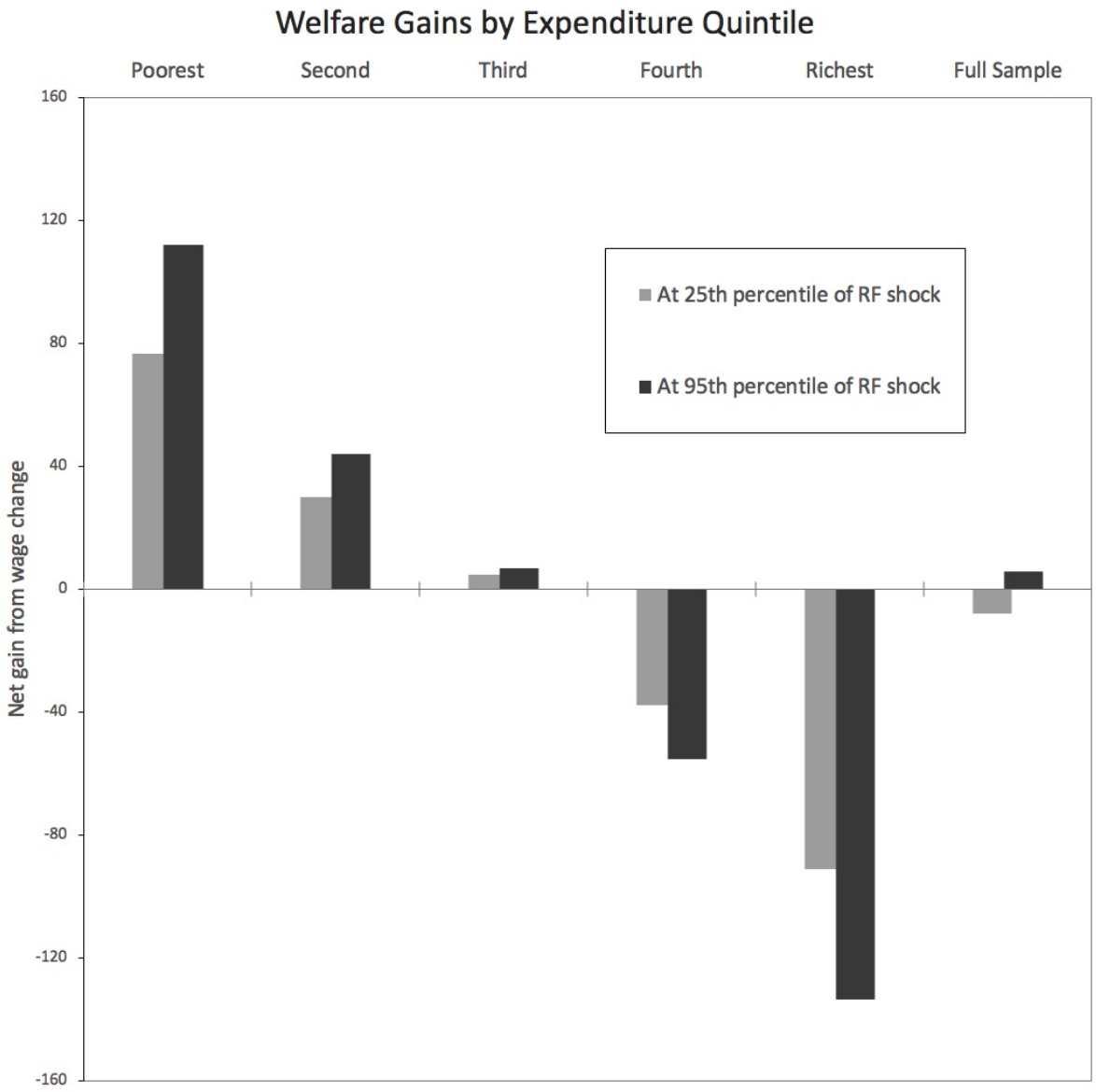

Figure 5: Gains from wage change at different intensity of monsoon shock by expenditure quintile

Notes: Welfare gains are expressed in Indian Rupees per household per month. The welfare gains for different intensities of monsoon shock is obtained from simulating the effect of PDS transfer on wages at the 25th and 95th percentile of monsoon onset, estimated in Table 17. See Table 18 for more details.

Table 1: State-level PDS policy changes

		(A) PRE-NFSA		(B) POST-NFSA		(C) NFSA Target (IV)	
	Item	Quantity	Price	Quantity	Price	Quantity	Price
				Oct-14			
Andhra Pradesh†	Rice	4 kg/indv (Max of 20kg/HH)	1 Re/kg	6 kg/indv (No ceiling)	1 Rs/kg	5 kg/indv	1 Rs/kg
	Wheat	No wheat ration					
				NFSA - Feb-14			
Bihar	Rice	15 kg/hh	7 Rs/kg	3kg/indv	3 Rs/kg	3kg/indv	3 Rs/kg
	Wheat	10 kg/hh	5 Rs/kg	2kg/indv	2 Rs/kg	2kg/indv	2 Rs/kg
Gujarat‡	Rice	5 kg/hh	3 Rs/kg	No changes		1kg/indv	3 Rs/kg
	Wheat	13 kg/hh	2 Rs/kg			4kg/indv	2 Rs/kg
Jharkhand	Rice	35 kg/hh	1 Re/kg	No changes		No changes	
	Wheat	No wheat ration					
				Anna Bhagya Yojana Jul-13			
Karnataka††	Rice	4 kg/indv	3 Rs/kg	30 kg/hh	1 Rs/kg	4kg/indv	3 Rs/kg
	Wheat	1 kg/indv (Max 25kg/HH)	3 Rs/kg	3 kg/hh	3 Rs/kg	1kg/indv	2 Rs/kg
				NFSA - Feb-14			
Maharashtra	Rice	10 kg/hh	6 Rs/kg	2kg/indv	3 Rs/kg	2kg/indv	3 Rs/kg
	Wheat	15 kg/hh	5 Rs/kg	3kg/indv	2 Rs/kg	3kg/indv	2 Rs/kg
				NFSA Apr 2014			
Madha Pradesh‡‡	Rice	2 kg/hh	4.5 Rs/kg	1kg/indv	1 Rs/kg	1kg/indv	3 Rs/kg
	Wheat	18 kg/hh	3 Rs/kg	4kg/indv	1 Rs/kg	4kg/indv	2 Rs/kg
				Feb-13			
Orissa	Rice	25 kg/hh	2 Rs/kg	25kg/hh	1 Rs/kg	No changes	
	Wheat	No wheat ration					

Notes: ∗ NFSA Targets assume that all states complied with the mandate in June 2013, when NFSA was officially enacted. †Andhra Pradesh decreased Rice price to Re. 1/kg in Nov-11. AP split into two states in 2014, namely Telangana and AP. In Oct 2014, Telangana increased rice quantity entitlement to 6kg/member and in April 2015 AP increased the quantity entitlement to 5kg/member. ‡ Gujarat enacted NFSA in 2016, which is not captured in our study time frame. †† Karnataka reduced wheat price to Re 1/kg in Oct-13 under the Anna Bhagya Yojana. ‡‡ Madhya Pradesh introduced Mukhyamantri Annapurna Scheme in July 2013 and reduced Rice price to 2 Rs/kg and wheat price to Re 1/kg. In Feb 2014, MP further reduced Rice price to Re 1/kg.
Source: Information on state-level PDS entitlements pre and post-NFSA (Columns A and B) comes from author's fieldwork and government records. The NFSA target IV (Column C) is based on the counterfactual scenario that assumes that in June 2013 each state only expanded by the minimum amount needed to comply with NFSA quantity mandate.

Table 2: Summary Stats

	AAY	BPL	APL/NoCard	Total
Number of HHs	105	579	533	1217
Number of members in the HH	4.706	4.724	5.040	4.861
	(2.125)	(2.238)	(2.377)	(2.296)
Nutrient and Calorie intake				
Calorie intake (Kcals)	2115.7	2032.5	2009.1	2029.7
	(740.9)	(794.8)	(746.3)	(770.1)
Protein intake (gms)	56.61	52.06	54.04	53.31
	(22.43)	(21.92)	(21.18)	(21.69)
Fat intake (gms)	39.21	37.92	46.74	41.84
	(19.53)	(35.99)	(25.96)	(31.07)
Consumption Quantity (in Kgs)				
Total Staple Cereals	12.82	11.46	10.43	11.13
	(5.886)	(5.546)	(5.608)	(5.648)
Quantity of pds grain consumed	7.259	5.400	1.183	3.742
	(3.905)	(3.883)	(2.511)	(4.067)
Pulses	1.066	1.035	0.964	1.007
	(0.704)	(0.811)	(0.677)	(0.748)
Expenditure and Income (in 2010 value)				
Food expenditure	558.2	596.7	715.6	644.7
	(236.4)	(305.3)	(359.1)	(330.6)
Non-food expenditure	518.7	667.3	757.5	693.4
	(1708.2)	(3221.9)	(3394.4)	(3197.9)
Total expenditure	1077.3	1264.7	1475.6	1339.4
	(1760.8)	(3278.9)	(3477.1)	(3267.4)
Implict PDS Subsidy	198.9	127.1	10.54	83.05
	(131.2)	(69.42)	(22.64)	(91.77)
Income total	1567.4	2243.5	2680.4	2375.9
	(4128.6)	(16946.8)	(13784.3)	(14878.5)

Standard deviation in parentheses. All values, except number of HHs and household size, represent the adult equivalent per household. Nutrient and Calorie intake is measured daily per-adult equivalent. Consumption quantity, expenditure and income is measured monthly per-adult equivalent.

Table 3: Validation of NFSA implementation

Panel A: Effect of NFSA Target on Entitlement			
	Entitlement		
	Quantity (kg)	Price (Rs/kg)	Transfer value (in 2010 Rs)
NFSA Target	0.870***	0.694***	0.781***
	(0.017)	(0.010)	(0.047)
F-stat			270.59
Observations	68622	70410	69148
Panel B : Effect of Entitlement on Consumption			
	Actual consumption		
	Quantity (kg)	Price (Rs/kg)	Transfer value (in 2010 Rs)
PDS entitlement	0.531***	0.704***	0.550***
	(0.042)	(0.040)	(0.041)
Observations	68622	70410	69148
Panel C : Effect of NFSA Target on Consumption			
	Actual consumption		
	Quantity (kg)	Price (Rs/kg)	Transfer value (in 2010 Rs)
NFSA Target	0.402***	0.484***	0.353***
	(0.042)	(0.042)	(0.073)
Observations	68622	70410	69148

Notes: Each coefficient estimate is from a separate regression with column heading as outcome variable and row heading as the regressor variable. Unit of observation is household-month. Each regression is estimated with household and time fixed effects. PDS entitlement refers to actual household level entitlements calculated based on the current year's state-level PDS policies at baseline household size and ration card status, as described in Section 4. NFSA target value refers to the counterfactual entitlements assuming that all states expanded PDS entitlements just enough to comply with the NFSA mandates, as described in Section 2. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 4: Effect of PDS transfer on Market Labor Supply

	Market Labor Supply (Mean = 18.92 days/month)			
PDS Transfer value	-0.0063**	-0.0063***	-0.0072***	-0.0072**
(IV : NFSA value)	(0.0026)	(0.0017)	(0.0020)	(0.0024)
Individual FE	X	X	X	X
Month FE	X	X	X	X
State trends	X			
Village trends		X	X	X
State-seasonal month FE			X	X
SE clustered at State-level				X
F-stat on excluded instrument	34.3	31.9	19.0	10.0
Observations	293308	293308	293308	293308

Notes: Each column presents the results of a separate regression. The coefficient estimates are from instrumented regressions of individual labor supply on PDS transfer value, with NFSA target value as the instrument. All regressions include individual and month fixed effects. Unit of observation is individual-month. Labor supply is measured in number of days per month, PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 5: Effect of PDS Transfer on Market Wages

	Market Wages (Mean = 227 Rs/day)			
PDS Transfer value	0.195**	0.145**	0.167***	0.167***
(IV : NFSA value)	(0.075)	(0.053)	(0.041)	(0.049)
Individual FE	X	X	X	X
Month FE	X	X	X	X
State trends	X			
Village trends		X	X	X
State-seasonal month FE			X	X
SE clustered at State-level				X
F-stat on excluded instrument	30.6	22.3	16.9	8.3
Observations	104040	104040	104040	104040

Notes: Each column presents the results of a separate regression. The coefficient estimates are from instrumented regression of individual wages on PDS transfer value, with NFSA target value as the instrument. All regressions include individual and month fixed effects. Unit of observation is individual-month. Wages are measured as daily wages in rupees per day. PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 6: Robustness tests for parallel trends in labor supply

	Market Labor Supply (Mean = 18.92 days/month)					
Reduced-form with Instrument						
NFSA target value	-0.00168**	-0.00185**	-0.00184***	-0.00194***	-0.00171***	-0.00191**
	(0.00065)	(0.00073)	(0.00064)	(0.00065)	(0.00057)	(0.00082)
Lead of NFSA target value		-0.00066	-0.00054	-0.00040	-0.00041	-0.00043
		(0.00061)	(0.00055)	(0.00054)	(0.00067)	(0.00048)
Individual FE	X	X	X	X	X	X
Month FE	X	X	X	X	X	X
Village trends	X	X	X	X	X	X
State-seasonal month FE			X			
State-month FE				X		X
Village-month FE					X	
Year FE # Baseline HH characterics						X
Observations	293308	23552	23552	23552	23552	232043

Notes: Each column represents the results of a separate regression. The coefficient estimates are from a regression of labor supply on NFSA target value (instrument). All regressions include individual and month fixed effects. Unit of observation is individual-month. Labor supply is measured in number of days per month, PDS transfer value is measured in 2010 Indian rupees. Baseline HH characteristics include occupation of household head, education of household head and caste group. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 7: Robustness tests for parallel trends in wages

	Market Wages (Mean = 227 Rs/day)				
Reduced-form with Instrument					
NFSA target value	0.05149**	0.03946*	0.04177**	0.04170**	0.03389**
	(0.02484)	(0.01992)	(0.01586)	(0.01570)	(0.01605)
Lead of NFSA target value		-0.00924	-0.01247	-0.01176	-0.02319
		(0.02554)	(0.02633)	(0.02664)	(0.02825)
Individual FE	X	X	X	X	X
Month FE	X	X	X	X	X
Village trends	X	X	X	X	X
State-seasonal month FE			X		
State-month FE				X	X
Year FE # Baseline HH characterics					X
Observations	104040	83765	83765	83765	83587

Notes: Each column represents the results of a separate regression. The coefficient estimates are from a regression of wages on NFSA target value (instrument). All regressions include individual and month fixed effects. Unit of observation is individual-month. Wages is measured as daily wages in rupees per day. PDS transfer value is measured in 2010 Indian rupees. Baseline HH characteristics include occupation of household head, education of household head and caste group. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 8: Robustness to state-time fixed effects

	Market Labor Supply (Mean = 18.92 days/month)				Market Wages (Mean = 227 Rs/day)		
PDS Subsidy value	-0.0063**	-0.0071**	-0.0071**	-0.0067***	0.195**	0.219***	0.220***
(IV NFSA value)	(0.0026)	(0.0030)	(0.0030)	(0.0020)	(0.075)	(0.076)	(0.077)
Individual FE	X	X	X	X	X	X	X
Month FE	X	X	X	X	X	X	X
State trends	X	X	X	X	X	X	X
State-seasonal month FE		X				X	
State-month FE			X				X
Village-month FE				X			
F-stat on excluded instrument	22.3	16.9	16.9	16.9	22.3	16.9	16.9
Observations	293308	293308	293308	293308	104040	104040	104040

Notes: Each column represents the results of a separate regression. The column headings represent the outcome variables. Coefficient estimates are from instrumented regressions with NFSA target value as the instrument for PDS transfer value. Unit of observation is individual-month. Labor supply is measured in number of days per month. Wages is measured as daily wages in rupees per day. PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 9: Robustness to spillovers

	Market Labor Supply			Wages		
	Full sample	Age 18-65	PDS Benefeciaires	Full sample	Age 18-65	PDS Benefeciaires
IV (Instrument: NFSA value)						
PDS Transfer Value	-0.00768**	-0.00730**	-0.01155*	0.16314**	0.19669***	0.16833*
	(0.00276)	(0.00273)	(0.00513)	(0.05025)	(0.05239)	(0.07299)
Individual FE	X	X	X	X	X	X
Month FE	X	X	X	X	X	X
Village Trend	X	X	X	X	X	X
Observations	292215	216625	183853	104040	96761	77053

Notes: Each column represents the results of a separate regression. The column headings represent the outcome variables. Coefficient estimates are from instrumented regressions with NFSA target value as the instrument for PDS transfer value. Unit of observation is individual-month. Labor supply is measured in number of days per month. Wages is measured as daily wages in rupees per day. PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 10: Robustness to controlling for NREGA variables

	Labor Supply					Wages				
PDS Transfer value	-0.0063**	-0.00624**	-0.00578**	-0.00618**	-0.00650**	0.195**	0.19211**	0.18532**	0.18039**	0.19189**
(IV NFSA value)	(0.0026)	(0.00259)	(0.00251)	(0.00264)	(0.00262)	(0.075)	(0.07563)	(0.07459)	(0.08105)	(0.08147)
Individual FE	X	X	X	X	X	X	X	X	X	X
Month FE	X	X	X	X	X	X	X	X	X	X
State trends	X	X	X	X	X	X	X	X	X	X
NREGA controls X BPL status										
Fiscal expenditures		X	X	X	X		X	X	X	X
Funds allocated from center to state			X	X	X			X	X	X
Number of HHs provided employement				X	X				X	X
Number of person days					X					X
Observations	293308	293308	293308	293308	293308	104040	104040	104040	104040	104040

Notes: Each column represents the results of a separate regression. The column headings represent the outcome variables. Coefficient estimates are from instrumented regressions with NFSA target value as the instrument for PDS transfer value. Unit of observation is individual-month. Labor supply is measured in number of days per month. Wages is measured as daily wages in rupees per day. PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 11: Association of PDS transfers with other social welfare programs

	Middaymeals	NREGA wages income	Pensions	Scholarships and Relief
PDS Transfer	0.002	0.016	0.015	-0.028
	(0.008)	(0.051)	(0.059)	(0.049)
Household FE	X	X	X	X
Month FE	X	X	X	X
Observations	69846	69846	69846	69846

Each column represents the results of a separate regression. The column headings represent the outcome variables with PDS transfer value as the regressor variable. All regressions include household and month fixed effects. Unit of observation is household-month. All variables are measured in 2010 rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 12: Labor supply effects, inside and outside household

	Outside household (Market)	Inside household	Total (Inside + Outside)
PDS Transfer value	-0.0063**	-0.0007	-0.0070
(IV : NFSA value)	(0.0026)	(0.0069)	(0.0080)
Individual FE	X	X	X
Month FE	X	X	X
State Trend	X	X	X
Mean	18.91	20.00	25.98
Observations	293308	293308	293308

Notes: Each column represents the results of a separate regression. The column headings represent outcome variables. Coefficient estimates are from instrumented regressions with NFSA target value as the instrument for PDS transfer value. All regressions include individual and month fixed effects and state-specific time trends. Unit of observation is individual-month. Labor supply is measured in number of days per month. PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 13: Labor market effects by market segment and gender

	Col A : Total Market		Col B : Market Segment				Col C : Gender			
			Non-farm		Farm		Male		Female	
	Labor Supply	Wages	Labor Supply	Wages	Labor Supply	Wages	Labor Supply	Wages	Labor Supply	Wages
PDS Transfer value	-0.0063**	0.195**	-0.0057**	0.251**	-0.0007	0.088*	-0.0106***	0.2232**	-0.0018	0.0678
(IV : NFSA value)	(0.0026)	(0.075)	(0.0021)	(0.096)	(0.0020)	(0.046)	(0.0032)	(0.1004)	(0.0033)	(0.0534)
Individual FE	X	X	X	X	X	X	X	X	X	X
Month FE	X	X	X	X	X	X	X	X	X	X
State Trend	X	X	X	X	X	X	X	X	X	X
Mean	18.9	227	20.97	269.30	12.84	150.50	20.08	261.99	16.52	155.60
Observations	293308	104040	293308	69780	293308	37330	150132	69689	143166	34348

Notes: Each column represents the results of a separate regression. The column headings jointly represent the outcome variables for the sub-sample classified by market segment and gender. Coefficient estimates are from instrumented regressions on PDS transfer value, instrumented with NFSA target value. Unit of observation is individual-month. Labor supply is measured in number of days per month. Wages are measured as daily wages in rupees per day. PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 14: Labor supply effects by occupation of individual

	Full sample	Farming	Farm labor	Non-farm labor	Livestock and Caste Occupation	Student	Domestic work	Business and Salaried Job
PDS Transfer value	-0.0063**	-0.0069	-0.0115	-0.0172*	0.0045	-0.0080***	0.0010	0.0034
(IV : NFSA value)	(0.0026)	(0.0074)	(0.0069)	(0.0090)	(0.0058)	(0.0026)	(0.0025)	(0.0103)
Individual FE	X	X	X	X	X	X	X	X
Month FE	X	X	X	X	X	X	X	X
State trends	X	X	X	X	X	X	X	X
Sample mean	18.9	16.5	16.8	20.5	19.1	18.3	15.5	25.2
Observations	293308	71413	26584	18491	12185	62183	59317	21178

Notes: Each column represents the results of a separate regression. Labor supply is the outcome variable. Column heading represents labor supply effects for each sub sample of individuals, classified by their main occupation. Coefficient estimates are from instrumented regressions with NFSA target value as the instrument for PDS transfer value. Unit of observation is individual-month. Labor supply is measured in number of days per month. PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 15: Labor supply effects by land size, income and caste

		Col A : Landholding size		Col B : Expenditure quintile		Col C : Caste group		
	Full sample	Landless and Small farmers	Medium and Large farmers	Bottom two quintiles	Top two quintiles	Scheduled	Backward	General
PDS Transfer value	-0.0063**	-0.0183**	-0.0004	-0.0071**	-0.0030	-0.0079**	-0.0072*	-0.0029
(IV : NFSA value)	(0.0026)	(0.0079)	(0.0064)	(0.0027)	(0.0036)	(0.0032)	(0.0042)	(0.0025)
Individual FE	X	X	X	X	X	X	X	X
Month FE	X	X	X	X	X	X	X	X
State trends	X	X	X	X	X	X	X	X
Sample mean	18.9	18.48	19.39	18.9	18.98	18.34	19.36	20.17
Observations	293308	40516	64539	116852	117161	86531	135786	70004

Notes: Each column represents the results of a separate regression. Labor supply is the outcome variable. Column heading represents labor supply for each sub sample of individuals, classified by their landholding size, expenditure quintile and caste. Coefficient estimates are from instrumented regressions with NFSA target value as the instrument for PDS transfer value. Unit of observation is individual-month. Labor supply is measured in number of days per month. PDS transfer value is measured in 2010 Indian rupees. Standard errors clustered at the village level in parenthesis. * p<0.10 ** p<0.05 *** p<0.01.

Table 16: Labor market effects with monsoon shock interaction

	Average Effect		Interaction effect	
	Labor supply	Wages	Labor supply	Wages
PDS transfer	-0.00618**	0.19272**	-0.00592**	0.18069**
(IV - NFSA value)	(0.00260)	(0.07393)	(0.00251)	(0.07247)
Monsoon shock	0.00430	-0.12477	0.00800*	-0.29173**
	(0.00320)	(0.07618)	(0.00439)	(0.13826)
Interaction			-0.00001	0.00045*
			(0.00001)	(0.00023)
Individual FE	X	X	X	X
Month FE	X	X	X	X
State Trend	X	X	X	X
Observations	293308	104040	293308	104040

The table reports the effect of PDS transfers on the labor market, interacted with monsoon shock. Unit of observation is individual-month.The results are for the full sample of individuals. Each column is a separate regression with PDS transfer value (instrumented with NFSA target value), monsoon onset and thier interaction as the regressor variables with individual and year fixed effects and state trends. Column headings describe the outcome variables. Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01.

Table 17: Seasonality in labor market effects

	Average Effect		With Interaction	
	Labor Supply	Wages	Labor Supply	Wages
IV (Instrument: NFSA target value)				
NFSA value x Lean	-0.00629**	0.19744**	-0.00600**	0.17902**
	(0.00268)	(0.07471)	(0.00250)	(0.07213)
NFSA value x Peak	-0.00614**	0.19128**	-0.00592**	0.18537**
	(0.00262)	(0.07473)	(0.00266)	(0.07345)
Rainfall				
Monsoon onset x Lean	0.00432	-0.11459	0.00829	-0.36723**
	(0.00518)	(0.10222)	(0.00680)	(0.16259)
Monsoon onset x Peak	0.00417	-0.12966	0.00766**	-0.21167
	(0.00346)	(0.08607)	(0.00289)	(0.14790)
Buffer effect				
Interaction x Lean			-0.00001	**0.00073****
			(0.00001)	**(0.00030)**
Interaction x Peak			-0.00001*	0.00021
			(0.00001)	(0.00024)
Individual FE	X	X	X	X
Month FE	X	X	X	X
State Trend	X	X	X	X
Mean	18.92	226.93	18.92	226.93
Observations	293308	104040	293308	104040

The table reports the effect of PDS transfers on the labor market, interacted with monsoon shock. Unit of observation is individual-month.The results are for the full sample of individuals. Each column is a separate regression with PDS transfer value (instrumented with NFSA target value), monsoon onset and their interaction as the regressor variables with individual and year fixed effects and state trends. Column headings describe the outcome variables. Dry is a dummy variable equal to one for January to June. Rainy is a dummy variable for July to Dec. Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01.

Table 18: Welfare Gains by expenditure quintile

	Expenditure quintile					Full sample	Remarks
	Poorest	Second	Third	Fourth	Richest		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Household expenditures and income							
1) Monthly HH consumption per capita	657	953	1205	1556	2139	1491	Sum stat
2) Total monthly consumption	2179	3317	4197	5349	9241	4936	Sum stat
3) Total earnings permonth for adults doing casual labor	1651	1146	885	480	397	908	Sum stat
4) Casual earning as a fraction of household consumption	0.76	0.35	0.21	0.09	0.04	0.18	(3) / (2)
Gains in household welfare from wage increase							
5) Estimated monthly hired labor costs per household	281	609	804	1154	2028	1052	Cultivation Schedule
6) Net labor earnings per month	1369	537	81	-674	-1632	-144	(3) - (5)
7) Wage change	8.6%	8.6%	8.6%	8.6%	8.6%	8.6%	Estimated from average effects
8) Net income gain from wage change	118.0	46.3	7.0	-58.1	-140.6	-12.4	(6) * (7)
Direct Gains from PDS transfer							
9) Proportion of PDS benefeciaries	73%	70%	55%	47%	33%	57%	Sum stat
10) Actual monthly PDS transfer valure received at current prices per household	284	234	208	180	123	216	Sum stat
11) Estimated monthly PDS entitlement value per household	311	281	245	216	198	254	Sum stat
12) Direct gain from 100 rupee PDS transfer	73	70	55	47	33	57	(9) * 100
Total gains							
13) Total gain from PDS transfer and wage change	191.0	116.3	62.0	-11.1	-107.6	44.6	(12) + (8)
Welfare gains from wage change							
14) As a fraction of total gains	62%	40%	11%	-	-	-	(8) / (13)
Welfare gains as a fraction of total expenditure							
15) Indirect gains from wage change	5.4%	1.4%	0.2%	-1.1%	-1.5%	-0.3%	(8) / (2)
16) Direct gains from PDS transfer	3.4%	2.1%	1.3%	0.9%	0.4%	1.2%	(12) / (2)
17) Total gain as a fraction of total expenditures	8.8%	3.5%	1.5%	-0.2%	-1.2%	0.9%	(13) / (2)
Welfare gains and monsoon shock							
18) Wage increase at 25th percentile of monsoon shock	5.6%	5.6%	5.6%	5.6%	5.6%	5.6%	Estimated from buffer effects
19) Net income gain from wage change at 25th percentile	76.7	30.1	4.5	-37.8	-91.4	-8.0	(18) * (6)
20) Total gains at 25th percentile of monsoon shock	360.7	264.4	212.5	142.2	31.6	207.8	(19) + (12)
21) Total gains at 25th percentile as a fraction of expenditures	16.6%	8.0%	5.1%	2.7%	0.3%	4.2%	(20) / (2)
22) Wage increase at 95th percentile of monsoon shock	8.2%	8.2%	8.2%	8.2%	8.2%	8.2%	Estimated from buffer effects
23) Net income gain from wage change at 95th percentile	112.3	44.1	6.6	-55.3	-133.8	-11.8	(22) * (6)
24) Total gains at 95th percentile of monsoon shock	396.3	278.3	214.6	124.7	-10.8	204.0	(23) + (12)
25) Total gains at 95th percentile as a fraction of expenditures	18.2%	8.4%	5.1%	2.3%	-0.1%	4.1%	(24) / (2)

Notes: Columns 1 to 5 correspond to different quintiles based on household per capita expenditure. Column 6 is all households. Column 7 describes how each row is obtained. Rows 1 to 3 is obtained from the ICRISAT data to compute averages for each quintile. The labor costs paid by each quintile is estimated from the Cultivation Schedule of the ICRISAT data (Row 6). The wage change in row 7 is equal to the program impact from the specification in Table 5. The direct gains of a 100 rupees increase in PDS transfers for each quintile is obtained from the proportion of households receiving the transfer in each quintile.

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Appendix A

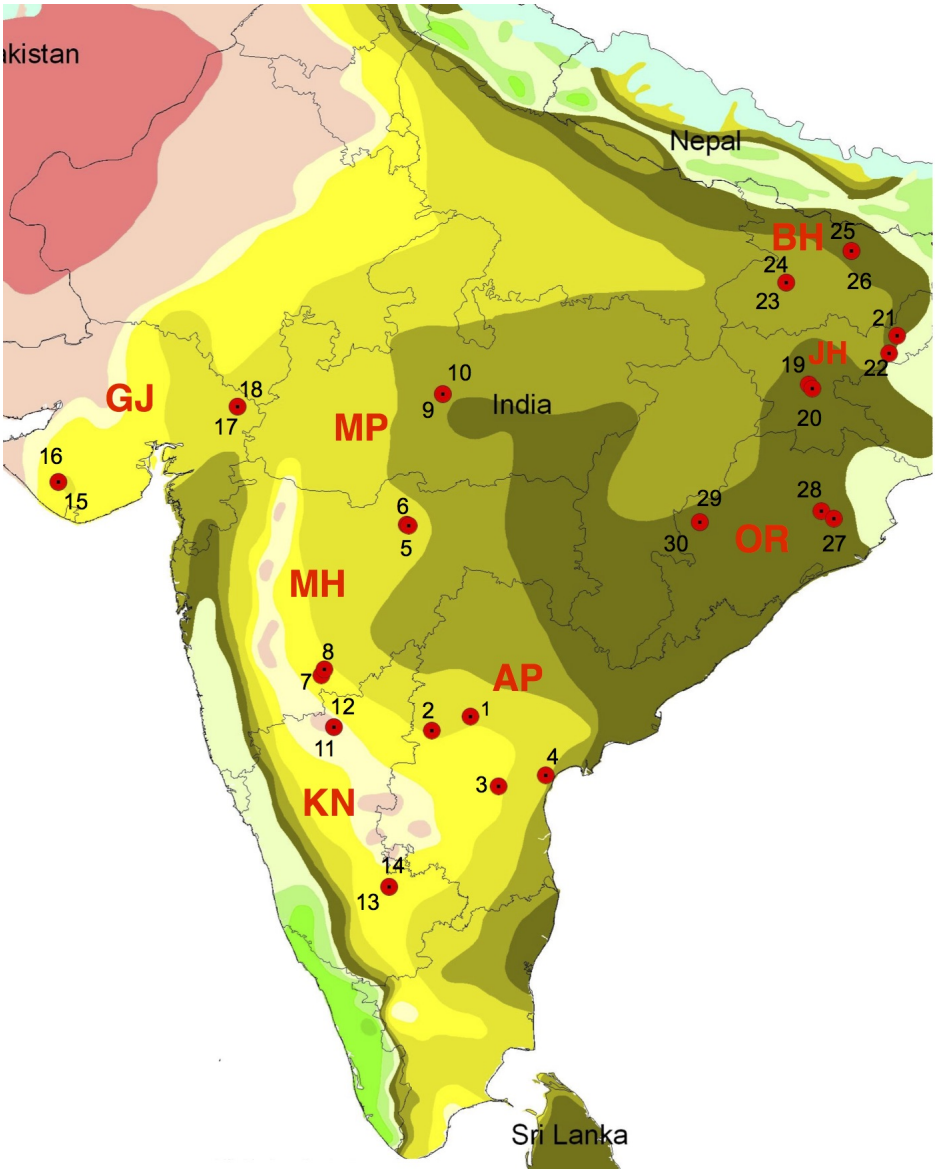

Figure A1: Location of ICRISAT VDSA villages - 30 villages across 8 states