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Can social safety nets protect public health? The effect of India's workfare and foodgrain subsidy programmes on anaemia

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Acknowledgements

Abstract

Can large-scale social safety nets be nutrition sensitive even if they do not explicitly incorporate health and nutrition as programmatic goals? This paper focuses on the consequences of a countrywide guaranteed workfare programme (MGNREGA) and subsidised food distribution scheme (PDS) in India for the prevalence of anaemia, examining whether individuals in districts with a broader reach of these mega-programmes are less likely to be anaemic. Using an Instrumental Variable (IV) approach to address the endogeneity of programme scale, we find that an individual residing in a district where the programmes have broader reach is less likely to suffer from all forms of anaemia and has a lower haemoglobin deficit from the benchmark suggested by the World Health Organisation (WHO) – ranging between 0.91 to 6.2 percentage points for a 10 percentage point expansion in programme scale. While the PDS seems to be more effective in reducing the incidence of mild anaemia than moderate or severe anaemia, while the strength of effects for MGNREGA seem to be the least for mild. These are catch-all effects that represent partial and general equilibrium impacts through multiple pathways. Programme interaction effects suggest the MGNREGA and PDS may be substitutes – associated improvements in anaemia for regions with higher PDS access (MGNREGA participation) are more pronounced when the scale of MGNREGA participation (PDS access) is low. There exist nonlinearities in these relationships, with the efficacy of both programmes varying across scales of implementation.

1 Background

It is currently widely recognized that policy levers to address food and nutritional security ought to include not just "nutrition specific" programmes that address the immediate causes of malnutrition but also "nutrition sensitive" interventions that work on a large scale and address a broader range of underlying causes of malnutrition. The coupling of these two approaches is now advocated as a way to tackle the persistent malnutrition problem in developing countries. (Ruel and Alderman, 2013). In general, however, the design of large scale social safety nets often do not explicitly factor in nutritional or public health goals nor acknowledge these links, even if they relate overtly to addressing issues of food access. Do these social welfare programmes nevertheless protect and promote health outcomes? This paper analyses the impact of two large-scale social welfare programmes in India – the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and the Public Distribution System (PDS) on health and nutrition of the rural population at large, focussing specifically on anaemia.

The MGNREGA is the largest public works programme in the world. It guarantees each Indian rural household a minimum of 100 days of manual, unskilled work, on demand, for wages established according to the task undertaken. Since its inception in 2006, it has generated more than 22.68 billion person days of work, involving expenditures of Indian rupees (Rs.) 3776.7 billion (US$58 billion).[1] Rolled out in three phases, the programme eventually covered all the districts in India by 2008. The PDS is the largest subsidised foodgrain distribution scheme in the world, with an allocation of 56.24 million tonnes of foodgrain across various component schemes during the year 2015-16. It has been operational since the 1960s and has continued, albeit with some major changes in the 1990s, that involved targeting the poor as opposed to universal coverage. The programme involves entitlements of rice and wheat, with pulses, flour, sugar and oil provided in several states, at subsidised rates.[2] Nationally representative data in India suggest that in 2011-12, around half of all rural households were buying some rice or wheat from the PDS and close to a quarter of all rural households had at

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[1] Days generated are as on March 14, 2017 and expenditures are cumulated in nominal terms valued at the exchange rate of Rs.65=US$1.
http://mnregaweb4.nic.in/netnrega/all_lvl_details_dashboard_new.aspx published on March 14, 2017.

[2] The National Food Security Act, 2013, guarantees 5 kilogram (kg) per person per month for priority households as identified by the state governments, 35 kg per household per month for Antyodaya Anna Yojana (AAY) households, and the excluded households have no entitlements. The subsidised price is Rs. 3 per kg for rice, Rs. 2 per kg for wheat, Rs. 1 per kg for coarse grains. However, different states offer additional subsidies on this price. For those over 60 years of age, Annapurna entitlements for grain offer 10kg of foodgrains per month.

least one member who had worked for at least one day on the MGNREGA during the year preceding the date of the survey (Table 1).

Programmes operating at this scale can be expected to have impacts not only on beneficiary households but also on rural households at large, through spillovers or general equilibrium impacts and there exists substantial literature documenting these effects. These include impacts on per capita consumption expenditure of participating households and rural poverty, more generally, but also as higher wage rates economy wide, that "lifts all boats"[3] (see Klonner and Odiges, 2014; Imbert and Papp, 2015, Zimmerman, 2013, for assessments of wage impacts of the MGNREGA). For the PDS, there is a perception, as yet unsubstantiated, that extensive subsidised grain distribution keeps food prices in the open market low.

Data challenges have so far prevented researchers from conducting studies that assess the ultimate impact of these two large-scale programmes on the health and nutrition of beneficiaries (See Narayanan and Gerber, 2017, for example, for a recent review). The paucity of data at the household level on both MGNREGA and PDS participation as well as individual health and nutritional status from a single survey implies that it is difficult to estimate the impacts of household level access to the PDS and participation in the MGNREGA on household members' health status. Studies that do comment on these impacts therefore typically focus on intermediary outcomes (like food consumption, or time spent on child care, for instance) and those that do address nutritional status of particular subpopulations (such as children) are typically based on small surveys restricted to specific geographies.

In this paper, we navigate this data constraint by focussing on district level scale of implementation and assessing programme impact on health/nutritional status of individuals, irrespective of whether they are direct beneficiaries or not. To do this, we combine different datasets to generate district level programme presence and individual data on health and nutrition, from a dataset representative of district level nutritional status, matched to districts based on domicile.[4] Given the significant spillover impacts of these programmes, one would expect that more extensive

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[3]This was articulated by Jairam Ramesh, the then Union Minister for Rural Development in a newspaper article on this subject in May 2013. http://www.thehindu.com/opinion/op-ed/rising-farm-wages-will-lift-all-boats/article4712302.ece. Accessed March 2014.

[4] This implies that we are unable to address the status of migrants. There are several concurrent efforts to obtain data on health and nutritional status at the district level. While the National Family Health Survey (NFHS) is representative at the state level, the District Level Household Survey (DLHS) is a health-focused survey in its fourth round 2012-13, with the previous rounds being in 1998-99 and 2002-04 and 2007-08. The early rounds were referred to as the RCH surveys. Further, there is the Annual Health Survey and more recently there is the HMIS that is being collected quarterly since 2010 under the National Rural Health Mission (NRHM). See Raban, et al. (2009) and Dandona, et al. (2016) for a review of Indian data on health and Meenakshi (2016) for an overview of nutrition in India.

implementation of the MGNREGA or PDS is associated with larger impacts overall – regardless of whether these impacts are positive or negative.

In this paper, we ask: is an individual who resides in a district that has a larger presence of the MGNREGA and PDS less likely to suffer from anaemia? Does he/she have better indicators of haemoglobin than an individual who lives in a district where the programmes have a more limited presence, controlling for confounding factors? Is there a threshold effect, so that these programmes have impacts only beyond a minimum scale of implementation? Further, do safety nets have similar impacts when anaemia is severe vis-à-vis when anaemia is less severe?

We define "programme presence" or "scale of implementation" to be the proportion of rural households within a district who participate in the MGNREGA or access the PDS, regardless of the intensity of participation. The emphasis is therefore on spread rather than depth. These treatment variables, captured at the district level, allow us to obtain estimates that are incorporative of many second round and general equilibrium impacts that might affect both beneficiaries and non-beneficiaries, but do not allow us to elicit the differential impact on participants/users and non-participants/non-users within the same district. Nor are we able to assess the impact of intensity of participation for beneficiary households. These remain limitations of the study.[5]

We focus on anaemia because it is a salient and serious nutrition-related public health concern in India. The country has one of the highest prevalence rates of anaemia in the world and accounts for perhaps the largest number of people with anaemia in any form (Table 1A and Table 1B). As with other nutritional indicators, anaemia in rural areas is consistently higher than urban rates and hence is the focus of this study. Improvements in overall anaemia in India between NFHS, Rounds 3 and 4 have been modest at best. This is despite consistent economic growth in terms of Gross Domestic Product (GDP).

Anaemia has several causes and is a manifestation of many complex processes. A recent meta-analysis suggests that less than half of anaemia prevalence is due to iron deficiency while the rest are likely driven by a range of other factors, such as other micronutrient deficiencies, genetic factors or infections, etc. (Petry, et al, 2016). Iron and other micronutrient deficiencies are, in turn, due to several factors including poor diets and infections, both of which have a strong association with poverty (Parischa, et al., 2010 for India, Benoist,et al., 2010). Safety nets such as the PDS and MGNREGA have the potential to influence many of these underlying causes of anaemia (the

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[5] Our study does not focus on how best to address anaemia or the relative efficacy of nutrition specific and sensitive programmes, but on whether these programmes and their co-existence have a nutrition impact.

pathways are described later). Our choice of anaemia as a focal outcome of interest is also because it has serious consequences for cognition, work effort and productivity, establishing conditions that reinforce poverty (Haas and Brownlie, 2001, Horton and Ross, 2003, for example). Recent illustrative calculations for ten developing countries, for instance, suggest that the median value of annual physical productivity losses due to iron deficiency is around $2.32 per capita, or 0.57% of GDP. Median total losses (physical and cognitive combined) are $16.78 per capita, 4.05% of GDP (Horton and Ross, 2003).

In this context, this paper investigates the potential that broad based social safety nets have to be nutritional sensitive and their role in addressing anaemia in India. Adopting an Instrumental Variable (IV) approach to identify impacts, since programme scale itself could be endogenous, a point we elaborate in a later section, we find that a person residing in a district that has greater reach of either programme is likely to have higher levels of haemoglobin, reduced deficit from the minimum benchmark of haemoglobin suggested by the WHO and is less likely to have anaemia. While the MGNREGA has a progressively stronger impact on more serious forms of anaemia, the pattern is the opposite for PDS scale of implementation – the PDS seems to be associated with a stronger impact on those who have milder forms of anaemia. Moreover, interaction of the two programmes is suggestive of these being substitutes in decreasing anaemia prevalence. In addition, there are non-linearities associated with the programmes, with both being effective in certain thresholds of scale of implementation and the programmes being most effective for the worst forms of anaemia. Our results are robust to different forms of the outcome variables, weighting schemes and alternate specifications, although the PDS appears to be more sensitive to alternate treatments of missing data. While an IV approach takes us close to endowing these results with a causal interpretation, given the complex nature of anaemia and despite our rich set of controls, we interpret them as strongly suggestive rather than conclusive evidence of a causal relationship.

The paper is organized as follows. Following this introduction, we present a conceptual framework describing potential pathways through which the PDS and MGNREGA can influence anaemia, highlighting areas where there could potentially be synergies or complementarities between these two programmes. We also provide a brief review of empirical evidence so far. Section 3 presents the methods – outlining the identification strategy, models estimated and details of data used. Section 4 discusses the results, first focussing on average effects and then exploring the heterogeneity in treatment effects. Section 5 ends with policy implications.

Table 1 A: Anaemia rates, India as against the Rest of the World (2011)

	Children (6-59 months)		Non-pregnant women (15-49 years)		Pregnant women (15-49 years)	
	Blood haemoglobin concentration < 110g/L (%)	Blood haemoglobin concentration < 70g/L (%)	Blood haemoglobin concentration < 120g/L (%)	Blood haemoglobin concentration < 80g/L (%)	Blood haemoglobin concentration < 110g/L (%)	Blood haemoglobin concentration < 70g/L (%)
India	59	1.8	48	2.5	54	1.3
Geographical Neighbourhood						
Bangladesh	56	1.1	43	0.7	48	0.5
Bhutan	55	2.3	44	2.2	46	1.2
China	19	0.1	19	0.3	22	0.2
Myanmar	40	0.7	30	1	33	0.7
Nepal	51	0.9	36	0.8	44	0.6
Pakistan	61	4.2	51	3.5	50	2.1
Sri Lanka	36	0.2	26	0.7	25	0.4
Rest of the BRICS Nations						
Brazil	24	0.2	19	0.8	32	0.5
Russia	26	0.3	21	0.5	23	0.2
South Africa	41	0.7	27	1.1	30	0.3

Note: Column 1,3,5 and 2,4,6 are respective thresholds for mild anaemia and severe anaemia
Source: The Global Prevalence of Anaemia in 2011 (WHO)

Table 1 B: Anaemia rates, MGNREGA participation and PDS access in rural India

	National Family Health Survey 3 (2005-06)	National Family Health Survey 4 (2015-16)	District Level Health Survey 4 (2012-13)
Proportion of children aged 6-59 months with anemia			
Any	71.5	59.4	75.1
Mild	26.5	NA	16.3
Moderate	42.1	NA	43.8
Severe	2.9	NA	15.0
Proportion of women aged 15-49 years with anemia			
Any	57.4	54.2	74.4
Mild	39.8	NA	16.4
Moderate	15.7	NA	44.8
Severe	1.9	NA	13.2
Proportion of men aged 15-49 years with anemia			
Any	27.7	25.2	70.1
Mild	14.2	NA	30.5
Moderate	11.9	NA	31.2
Severe	1.6	NA	8.4
MGNREGA and PDS Scale of Implementation			**NSS (2011-12)**
Participation rate MGNREGA (2011-12)			23.2
Proportion of rural households accessing PDS (2011-12)			51.8

Note: (1) Figures for anemia are estimates for rural India. All India NFHS-3 data includes all states except Nagaland. (2) MGNREGA participation rate is the proportion of households where a single adult member got work under the program and PDS access rate is proportion of households getting wheat or rice via the program. (3) For details on states covered under DLHS 4, refer to the appendix Table 4. NA means not available. (4) We note here a difference between estimates of anemia as per the NFHS and DLHS, especially for men in age group 15-49 years (see also Meenakshi, 2016 for a comparative perspective). One plausible explanation for this is on account of measurement techniques. Whereas the NFHS relies on Haemocue (HQ) method for estimation of haemoglobin level, the DLHS, National Nutrition Monitoring Bureau (NNMB), Indian Council of Medical Research (ICMR) Micronutrient surveys use the cyanmethaemoglobin method. Literature suggests that the HQ method overestimates haemoglobin levels, thus underreporting prevalence of anemia (Kalaivani, 2009; Bhaskaram, et al., 2003; Kapoor, et al., 2002; Mohanram, et al., 2002; Saxena and Malik, 2003). An alternate explanation for this difference could be the nature of the sample and coverage; these vary across the NFHS and DLHS. For example, micro-studies on smaller samples point to amenia rates among adult men closer to the DLHS than to those suggested by the NFHS (Malhotra, et al., 2004; Mohanty, et al., 2008).

Source: All India report for NFHS-3andNFHS-4, authors' calculations using DLHS 4

2. Conceptual Framework

The MGNREGA and PDS can influence anaemia in multiple and potentially conflicting ways. A key pathway to lower anaemia involves better and more diverse diets enabled by increased income from the MGNREGA on the one hand and implicit income transfers implied by subsidies on foodgrain from the PDS, on the other. In the case of PDS, however, if provision of subsidised grain crowds out, rather than crowding in, a diverse food basket or more nutritious grains, it could impact dietary quality adversely. Increased income from MGNREGA or freed-up food expenditures due to PDS can also be used to make a variety of investments in health, for example, child immunization, institutional delivery of mothers, their antenatal and postnatal care, etc. and also be used to secure access to household amenities such as drinking water, toilet, electricity, clean cooking fuel.[6] At the same time, to the extent that the MGNREGA attracts especially women's work effort, it could crowd out health seeking and childcare time with possible adverse impacts on child and adult health. Since the MGNREGA work involves substantial physical effort, if it is not compensated with adequate intake of calories it could leave adults worse off. In particular, poor implementation quality, for example delays in wage payments, can potentially leave the workers worse off in terms of health and nutrition.

On the other hand, the MGNREGA creates, although with varying degrees of success, rural infrastructure (like connectivity, rural roads, toilets, water storage facilities, etc.) that could reduce work effort and improve access to health care and amenities that help redressing anaemia. There is anecdotal evidence from many marginalized communities that the construction of a simple road or path can improve access to health care facilities or childcare centres substantially (Ranaware, et. al, 2014, for example). MGNREGA works that increase agricultural productivity and incomes could have a similarly positive impact (Aggarwal, et al, 2012, Esteves, et al, 2013). That said, to the extent that these increase women's work effort, they could have detrimental impacts as well.

In the end, whether districts that have these programmes also experience improvements in health and nutritional status of domiciled individuals remains an empirical question. The links between the MGNREGA and PDS and health outcomes can thus happen through multiple pathways and have complex, even

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[6]It would of course be erroneous to presume that the implicit income effects of the MGNREGA and PDS would automatically enable beneficiaries seek healthcare services or invest in infrastructure. Access to infrastructure that supports good health and nutrition could be driven mainly by their availability, supply side factors in the first place.

counterbalancing effects. It is also apparent that both these programmes, apart from impacting participant or beneficiary households could have general equilibrium impacts as well as spillover effects, for example through wage increases or changes in the relative prices of food, that might influence the health and nutritional status of non-beneficiaries in the area.

So far, research on the PDS and MGNREGA suggest that the implicit and explicit transfers, respectively, associated with these programmes allow increases in consumption and food expenditure. The MGNREGA could also enable households to avoid periods of hunger by smoothing consumption over time (Klonner and Oldiges, 2014, Imbert and Papp, 2015, for example). The PDS might crowd in more diverse diets (Kaul, 2014; Jha, et al., 2011). A direct impact of the PDS is in increasing calorie consumption and studies suggest a range of limited to modestly positive impact on calorie intake (Kochar, 2005 for PDS wheat buyers; Kaul, 2014 for PDS rice users, Ray 2007, Krishnamurthy, et al., 2014 for rice buyers in Chhattisgarh; Himanshu and Sen, 2013) or even negligible impact (Kaushal and Muchomba, 2013). The impact of the PDS on overall diet quality is however less clear. It could be either negative (where cheap grains crowd out diverse diets, Khera (2010)) or positive (where subsidies on the major grains frees up purchasing power to buy diverse diets and hence crowds in diets, Kaul (2014), Krishnamurthy, et al. (2014) Rahman (2014)). Given existing evidence on these intermediate outcomes, our goal is to see if these programmes can ultimately impact health outcomes, such as anaemia. Limited evidence using the Indian Human Development Survey, that captures both anthropometry and programme participation suggests that the PDS does not have an impact on under-nutrition among children, as measured by their weight-for-age status (Desai and Vanneman 2015) or on adult BMI (Government of India, 2016).

3. Methods

3.1 Data

The data we use come primarily from three large surveys. We use nationally representative data from the 68th Round of the National Sample Survey (NSS) of households in rural areas – the Employment and Unemployment Survey and Consumption Expenditure Survey, which cover 59,129 and 59,700 rural households, respectively. These data, pertaining to 2011-12, include MGNREGA participation and PDS access respectively and as such we can derive district level estimates of programme presence or scale of implementation.[7]

For the MGNREGA, we use participation data of the household (whether or not any member of the household worked on the MGNREGA during the year preceding the date of survey) and use this to obtain district level participation rates, i.e., the proportion of rural households in a district who worked on the MGNREGA at least once during the year preceding the date of survey. For the PDS, district estimates of access is defined as the proportion of rural households in the district who bought any grain from the PDS during the month preceding the date of survey, at the district level, as representing the benefits transferred by the PDS.[8]

Unfortunately, the National Sample Survey that has the PDS data does not have MGNREGA participation and vice versa – district level estimates of these are therefore generated from different NSS surveys. We prefer these survey-based estimates of participation to administrative data for two reasons. First, it is difficult to get data on PDS use at the district level, even though this is more easily available for the MGNREGA. Second, and more importantly, administrative data do not factor in leakages and tend to over-report actual participation in MGNREGA and consumption in PDS. To the extent that administrative data remain unverified, they could be associated with measurement errors.[9]

Data on anaemia and other health and nutrition indicators are from a third source, the District Level Health Survey 4 (DLHS-4) conducted in 2012-13 by the Ministry of Health and Family Welfare, Government of India[10] It contains information on

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[7] Ever since the 60th Round of the NSS, these data are representative at the district level.

[8] In this paper we focus on the proportion of households who benefit from the programme as a metric of scale and ignore the intensity of participation. To that extent our results could be conservative estimates of benefits, if any. Also, the PDS can be a source of many other commodities (e.g. sugar and kerosene). Here we only deem a household to have used PDS if they buy rice or wheat from the PDS.

[9] In fact typically studies use administrative data to compute the difference between the NSS household reported consumption/MGNREGA participation to estimate leakages (Drèze and Khera, 2015; Khera, 2011a & 2011b; Imbert and Papp, 2011; Khera, 2011a; Khera, 2011b)

[10] For more on this data, see (Appendix Table 1)

household level characteristics and the Clinical, Anthropometric and Biochemical (CAB) component provides information for consenting individuals on haemoglobin levels and Body Mass Index (BMI). The survey covers 947,784 individuals across 220,014 households in rural and 648,711 individuals across 156,488 households in urban areas respectively. Haemoglobin levels were recorded for 652,595 and 437,000 individuals in rural and urban areas respectively.

Unlike the NSS, however, the DLHS-4 data are available for only 18 States and 5 Union Territories.[11] This study focuses on a subset of rural districts in states for which data on anaemia and MGNREGA and PDS participation are available – covering 18 states, 1 Union Territory, 237 districts, 570,567 individuals in rural India. This sample is therefore not necessarily representative of the entire country and indeed the states covered exclude the poorest states and those where the anaemia rates are much higher and programme implementation of MGNREGA and PDS much poorer (Appendix Table 4 provides a comparative perspective).

A set of critical assumptions underpins the analysis. The time gap between the anaemia measures (2012-13) and PDS and MGNREGA presence at the district level (2011-12) renders valid estimates of relationships under either of two specific assumptions – first, that the impact of social safety nets has a lagged response on health/nutritional status and/or second, that the programme presence of the PDS and MGNREGA in 2011-12 correspond broadly to the coverage over the entire period and can therefore be interpreted as the impact of sustained or cumulative presence of the programme at that scale in recent years.

In the case of anaemia, both assumptions are tenable in a limited sense. Anaemia is known to fluctuate over the short term depending on inflammation, infection, food intake and so on but this is more likely the case with mild rather than worse forms of anemia (Roba, et al, 2015, for example). At the same time the high correlations we find in district level anaemia rates between the DLHS-2 in 2002-04 and DLHS-4 in 2012-13 suggests persistence. As for the latter assumption, data on participation rates from the National Sample Survey for 2009-10 and 2011-12, the scale of participation has remained similar despite the fact that these years include a drought year (that see higher work-seeking) and a normal rainfall year.[12] For the PDS, the years between

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[11]These include Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Chandigarh, Daman and Diu, Delhi, Goa, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Punjab, Sikkim, Tamil Nadu, Telangana, Tripura, West Bengal, Puducherry.

[12]Recent evidence suggests that participation in MGNREGA in terms of number of households is relatively stable even in drought years (such as 2009-10) where higher work seeking does not translate into higher participation rates due to administrative rationing (Narayanan, et al., 2017). Further the scale of the MGNREGA, as per administrative data, declined since 2009 until 2012-13, so that ours are probably conservative measures of programme scale.

2004-05 and 2009-10 has seen expansion and reform in several states (See Drèze and Khera, 2015, for instance) so that the PDS access rate has increased. In the case of the PDS, more than for the MGNREGA, a more cautious interpretation of the results is warranted. Notwithstanding this issue, there is moderately high linear correlation between district scales of implementation across years. These were 0.761 for MGNREGA and 0.768 for PDS, suggesting that despite overall improvements, there is stability in the ranking of districts in terms of programme scale.

Figure 1 shows the pattern of scale of implementation of the MGNREGA and PDS in the districts, grouped by state, relative to the All-India average. It appears that the scale of implementation of the PDS and MGNREGA are only modestly correlated (0.288 in 2011-12). When a state has districts with relatively large PDS presence, this does not necessarily imply that these districts also have a large MGNREGA presence and vice versa. This allows for the possibility of separating their effects and exploring the interactive impact of these two programmes. While states such as Tamil Nadu, Andhra Pradesh, Himachal Pradesh have above average programme reach in both the PDS and the MGNREGA, at the opposite end are Punjab and Haryana with neither. States such as Karnataka, Maharashtra have better implementation in one programme rather than the other.

Figure 1: District level scale of MGNREGA and PDS, grouped by state (2011-12)

Statewise distribution of districts based on PDS and MGNREGA use
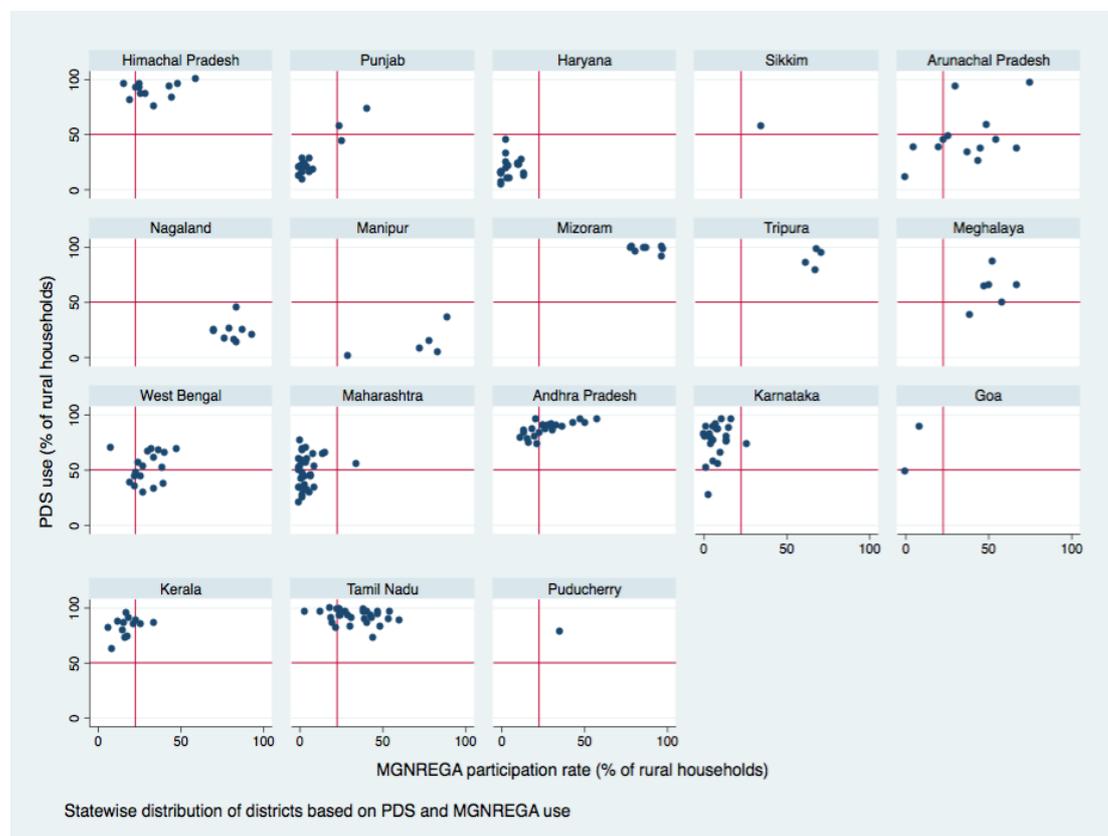
3.2. Empirical Strategy

Estimating the impact of these social welfare programmes on anaemia is frustrated by two major factors. First, anaemia is influenced by several different factors such as epidemiological conditions in the district and changes in food consumption, dietary intake of water and work effort, health and sanitation, etc. that may be correlated with programme uptake of the MGNREGA and PDS. Unless we account for a rich set of controls representing these, it is possible to misattribute changes in anaemia to the PDS and MGNREGA. Though solutions to the problem of misattribution are discussed at length subsequently in this section, we nevertheless incorporate a rich set of controls that could potentially influence anaemia through multiple pathways, including household and village level access to water and sanitation, health infrastructure, credit facilities, other targeted welfare programmes, among other things. This strategy partials out the effects of these alternate channels from those associated with the PDS and MGNREGA, even though income transfers from the programmes could have influenced some of these alternate channels themselves (for example, investments in toilets or improved water sources). In this sense, the rich set of controls would if at all, yield under-estimates of true programme impacts.

A second, related, concern is endogeneity that comes from omitting variables that are unobservable. In the case of both programmes, some districts are able to implement these and other programmes that can influence anaemia through other pathways better than other districts. If there is a systematic difference between the good and poor implementers, this would lead to biased estimates of impacts since better (worse) implementing states or districts are also likely to have good (poor) health indicators, to the extent that they might implement all schemes well (poorly). In this case, we would wrongly attribute the impacts to the mega-programmes whereas it could be on account of unobserved factors. On the other hand, if we expect the poorer regions, that also have, on average, worse health indicators, to also access the MGNREGA and PDS more widely, so that the scale of implementation in these districts is higher, this would be less of a problem since the bias would go the other way and, in fact, support any finding of positive links that we might establish.[13] In this case, any positive impacts we detect are likely to be conservative estimates of true impacts.

Further, there could be reverse causality, especially in the case of the MGNREGA. Since the MGNREGA involves strenuous work and wage rates are linked to work done,

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[13] It is less of a concern that the MGNREGA is a demand driven programme. Given the large number of research studies that suggest that the MGNREGA is not demand driven but rather supply driven, the scale of MGNREGA can be regarded as exogenous, after controlling for key socio-economic and demographic characteristics of the district (Khera, 2014; Himanshu, et al., 2015, Narayanan, et.al, 2017).

districts with higher anaemia rates could cause MGNREGA participation rates to be low.

To resolve potential endogeneity on account of any of these reasons, we adopt an instrumental variable (IV) approach. For the MGNREGA participation rate, we use administrative rationing rates in the district as an instrument for identification. There is considerable evidence suggesting that the MGNREGA, though ostensibly demand driven, is constrained by supply. Administrative rationing (wherein those seeking work are not provided work) is widespread and tends to influence the scale of implementation (Liu and Barrett, 2013; Dutta, et al., 2012), typically associated with a lower participation rate (the correlation coefficient for 2011-12 is -0.533). However, the rationing rate within the MGNREGA in itself cannot independently affect an individual's anaemia status except via their ability to participate in the MGNREGA. To the extent that district characteristics could influence both rationing rate and individual's anaemia status (backwardness, etc.) we control for several of these in the outcome regression (discussed later) to strengthen the validity of the exclusion restriction criterion.

For PDS access rate, we use PDS-market price differential as instrument. Several authors point out that the market price-PDS price differential, which represents the implicit income transfer, is positively correlated with PDS use (0.429 in our sample). Under the assumption that the market price fluctuations are exogenous sources of variation (more on this later) that influence PDS purchase behaviour, these can potentially serve as an instrument for PDS use.[14] The PDS price is fixed by the state and itself tends to change, though less frequently than market price. While market prices per se can influence consumption bundles overall and hence influence anaemia via adjustments people might make in their consumption basket, the price differential between the PDS and open market grains only affects anemia rates, if at all, via its influence on PDS use. Individual state governments fix the PDS prices within state and in no state is the fixation of this price related or linked to market prices. Indeed, the fixing of PDS price is often a political tool. Even if the PDS price influences market prices, of which there is no evidence, it is unlikely to have a deterministic relationship with the price differential. For example, in states such as Tamil Nadu, PDS rice is free but the open market price co-moves with those in other cities and is closer to open market prices elsewhere than to the PDS price.[15]

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[14] Chakrabarti, et al (2016) discuss the relationship between price differential and PDS uptake and exploitation of arbitrage opportunities by traders. They find ambivalent results at the state level and suggest these are highly context dependent effects.

[15] We choose the price differential for wheat, because of its stronger relevance in our diagnostics, but our analysis goes through if we use rice price differential instead.

In the first model (Equation 1), we regress log of haemoglobin of an individual (in grams per decilitre of blood; Y_{ihvdst}) measured in 2012-13 on the district level participation rate in the MGNREGA in 2011-12 ($MGNREGA_{dt-1}$), district rate of access to the PDS (PDS_{dt-1}) in 2011-12 and the interaction of these two, also in 2011-12. We use, in addition, a rich set of controls measured in 2012-13 at the individual (I_{it}), household (X_{ht}), village (Z_{vt}), district (Z_{dt}) and state (W_{st}) levels. Equations 1a, 1b and 1c represent the first stage regressions to address the problem of endogeneity. We use rationing rate, the market price-PDS price differential as instruments for MGNREGA and PDS access rates and use the interaction of these as instruments for the interaction term in the second stage regression (Esarey, 2015). [16]

$$Y_{ihvdst} = \beta_0 + \beta_1 MGNREGA_{dt-1} + \beta_2 PDS_{dt-1} + \beta_3(MGNREGA_{dt-1} * PDS_{dt-1}) + \beta_4\, Y_{d0} + \beta_5\, I_{i\,t} + \beta_6 X_{h\,t} + \beta_7 Z_{v\,t} + \beta_8 Z_{dt} + \beta_9 W_{st} + \varepsilon_{ihvdst} \qquad (1)$$

$$MGNREGA_{dt-1} = \gamma_0 + \gamma_1 RationingRate_{d\,t-1} + \gamma_2 Y_{d0} + \gamma_3 I_{i\,t} + \gamma_4 X_{h\,t} + \gamma_5 Z_{v\,t} + \gamma_6 Z_{dt} + \gamma_7 W_{st} + \epsilon_r \qquad (1a)$$

$$PDS_{dt-1} = \pi_0 + \pi_1 PDS\,price\,diffl_{dt-1} + \pi_2 Y_{d0} + \pi_3 I_{i\,t} + \pi_4 X_{h\,t} + \pi_5 Z_{v\,t} + \pi_6 Z_{dt} + \pi_7 W_{st} + \epsilon_p \qquad (1b)$$

$$(MGNREGA_{dt-1} * PDS_{dt-1}) = \mu_0 + \mu_1(RationingRate_{d\,t-1} * PDSprice\,diffl_{dt-1}) + \mu_2 Y_{d0} + \mu_3 I_{i\,t} + \mu_4 X_{h\,t} + \mu_5 Z_{v\,t} + \mu_6 Z_{dt} + \mu_7 W_{st} + \epsilon_q \qquad (1c)$$

Y_{d0} refers to anaemia rates (mild, moderate and severe) in respective districts in 2002-04 (as per DLHS-2), before the MGNREGA was introduced.

Another outcome indicator we use is the difference in measured haemoglobin from the age-sex specific thresholds established by the World Health Organisation (WHO), expressed as percentage of the thresholds (See appendix Table 5 for these

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[16] In the sample used for analysis, the average haemoglobin level (grams per decilitre) for rural India is 10.73 g/dl and we restrict the sample to those with values in the range 1 to 30. The average percentage shortfall/excess relative to age-specific WHO thresholds is -12.15. The advantage of using actual haemoglobin levels rather than anaemia status is that it is free from clustering patterns around the thresholds.

thresholds).[17] When the difference is positive, the individual is not anaemic, and when it is negative, the individual is anaemic and the metric we use measures the distance or extent of deficit from thresholds defining anaemia. For both outcome measures, if β_1 and β_2 are positive, then the PDS and MGNREGA promote health via associated improvements in haemoglobin levels.

In an alternate model (Model 2) we focus on any anaemia status as the relevant variable – mild or worse, moderate or worse, severe anaemia and estimate probit models with the same set of variables, with the first stage equations, 1a, 1b and 1c as in Model 1.

$$Pr(Y_{ihdt} = 1) = F(\beta_0 + \beta_1 MGNREGA_{dt-1} + \beta_2 PDS_{dt-1} + \beta_3 (MGNREGA_{dt-1} \times PDS_{dt-1}) + \beta_4 Y_{d0} + \beta_5 I_{it} + \beta_6 X_{ht} + \beta_7 Z_{vt} + \beta_8 Z_{dt} + \beta_9 W_{st} + \varepsilon_{ihvdst}) \quad (2)$$

In this case, the sample of those with severe anaemia is a subset of the sample with moderate or worse anaemia, which itself is a subset of those with mild or worse anaemia.

In both models, the problem of attribution would still exist given the complex range of factors than can influence health and nutrition and possibly MGNREGA and PDS use. In order to mitigate some of these issues, we adopt three broad strategies and at multiple levels, opting for detail rather than parsimony. First, we control for several individual, household and village characteristics that could influence anaemia, including age-gender-martial status, occupation, chronic illness, household participation in other programmes, access to improved water and sanitation, health infrastructure (See Appendix Table 1 and 3 for a detailed list of variables included in the regression). Second, we control for district level anaemia rates before MGNREGA was implemented, from the second round of the DLHS survey (2002-04). Anaemia rates in 2002-04 are presumed to capture all relevant information during the time preceding the roll out of the MGNREGA and the already present PDS and older food for work programmes up until that time. These would presumably capture baseline anaemia rates that might predict later anaemia rates. Third, we introduce controls of alternate determinants of anaemia in the period 2004-05 to 2012-13 – these include cumulated per capita government expenditure on health, nutrition and sanitation, district rainfall shocks (both positive and negative) over the entire period. We control for state domestic product per capita in 2012-13 but also include the average year on

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[17] Some argue in statistical epidemiology literature in favour of using continuous variables rather than dichotomous on grounds that it weakens the power of statistical tests (Royston, Altman and Sauerbrei, 2006, for example).

year growth rate in per capita state domestic product over the period 2004-05 to 2012-13to proxy for economic growth in this time. Further, given that there could be systematic differences across states or similarities between districts within a state in terms of implementation efficiency, we include state level leakage rates in the PDS and MGNREGA (Drèze and Khera, 2015 and Imbert and Papp, 2011). Accounting for these notions of efficiency, we are able to isolate the `scale' effect of the programme from those that might have to do with administrative efficiency. [18]

Errors are clustered at the household level to account for correlations within the household. Where these led to estimation problems we report robust standard errors. For observations that are missing data for some controls, we use a set of dummy variables to denote missing data.[19] Where either the dependent variable, the focal variables of MGNREGA participation and PDS access rates at the district level or any of the instruments is missing, we exclude these data from the analysis.

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[18] We prefer this conceptually to state dummies that could in fact proxy for scale of implementation at the state level, our variable of interest.

[19]We implemented two versions of these. In the first, we included one missing data dummy for each control. In the second, we included a missing data dummy if any of the controls were missing.

4 Results and Discussion

Table 2 presents the summary statistics and Table 3 summarizes the key results for the focal variables of interest from the estimations of Models 1 and 2 along with formal diagnostic tests for instrument validity.[20] We present the unweighted regressions, but find that using weights to account for sampling does not change the results.

The descriptive statistics are a grim reflection of prevailing health status of individuals in the sample states that are, in fact, regarded as above average performers in India. On average, there is a shortfall in haemoglobin level from group-specific WHO thresholds of about 12%. Average MGNREGA participation for the districts in the sample is about 20% while average PDS access rate is about 62%.

In general, as the PDS and the MGNREGA scales of implementation increase, these are associated with lower anaemia measured variously – whether in terms of haemoglobin levels, shortfalls from the threshold or in terms of proportion of people with anaemia. Findings in columns 1 and 2 of Table 3 suggest that on average, an increase of ten percentage points in MGNREGA participation rate, ceteris paribus, is associated with an increase of 2.9 per cent haemoglobin levels and a narrowing of the deficit from the threshold by 2.1 percentage points. A similar increase in PDS access rate has associated increases of 3.1 per cent increase in haemoglobin levels and 3.5 percentage point reduction in deficit from the threshold.

A larger scale of implementation for PDS and MGNREGA is, on average associated with lower likelihood of suffering from mild or worse, moderate or worse and severe forms of anaemia (columns 3,4 and 5 of Table 3). An individual residing in a district where MGNREGA participation (PDS access) rate expands by ten percentage points, ceteris paribus, is 4.0 percentage points (4.2 percentage points) and 2.8 percentage points (0.9 percentage points) less likely to have moderate or worse and severe forms of anaemia respectively. For any anemia (i.e., mild or worse), with a ten percentage point expansion in PDS and MGNREGA, ceteris paribus, an individual is 6.2 and 2.1 percentage points less likely to be anaemic, respectively. The scale of PDS seems to be more effective in reducing the incidence of mild or worse anaemia than moderate and worse or severe anaemia, while the strength of effects for MGNREGA seem to be the least for mild or worse forms of anemia. The most plausible explanation for this difference in patterns of impacts is that the spillover impacts of the MGNREGA (for example, increase in wages) are stronger than than for PDS and these spillovers are likely to impact someone with severe anemia more. It seems unlikely that those with

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[20] We do not discuss the controls in these regressions, although these are interesting in their own right. Supplementary materials contain the full results.

higher levels of anemia are benefitting more from MGNREGA than the PDS as participants of the programme, given that the MGNREGA involves physical work and wages are linked to work done each day.

We interpret these as causal, given our IV approach and rich set of controls, acknowledging that the IV approach has its own limitations as a strategy for identifying causal impacts. We find that the two programmes are independently effective but the interaction of the scale of these two programmes is weaker than the sum of the independent associations, suggesting that they may be substitutes. Given that the MGNREGA is physically demanding whereas the PDS is not but does involve transactions costs in access to rations, it is conceivable that in several districts, sub-populations may be selecting into one rather than the others based on their capacity and preference for hard work.[21] It is also conceivable if, for example, the income effects of these programmes are the main channels through which they impact nutritional status – the PDS by providing an implicit transfer and the MGNREGA by supplementing or smoothening their incomes, conditioned on delays in wage payments. It could be the case too that the incomes accrued when both programmes are in place, now being significant higher, are channelled into long term savings or investments, away from current consumption or to liquidate debts, that might not be the case if the households benefited from only one or the other programme. However, given the complex and unexplored dynamics of redressing anaemia in different contexts, we remain agnostic about the actual pathways that underlie these relationships.

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[21] For a perspective of the `unpleasant' nature of the MGNREGA, see Lagrange and Ravallion (2012)

Table 2 : Sample Summary Statistics for key variables of interest (N=481723)

	Mean	Standard Deviation
Outcome variables		
Haemoglobin differential from WHO benchmark (2012-13) (%)	-12.15	21.09
Haemoglobin level in gm/dl (2012-13)	10.73	2.65
Proportion with mild or worse anaemia (%)	72.88	
Proportion with moderate or worse anaemia (%)	52.50	
Proportion with severe anaemia (%)	12.11	
`Treatment' Variables		
MGNREGA participation rate (2011-12) (%)	20.18	19.80
PDS access rate (2011-12) (%)	62.24	28.16
Instruments		
MGNREGA rationing rate *(2011-12)* (%)	27.79	28.92
Unit value-PDS price differential for wheat in Indian Rupees*(2011-12)*	11.71	5.90

Note: For details on control variables and summary statistics for the list of controls, refer to Appendix Table 2. The difference in the values of MGNREGA participation and PDS access rates and anaemia rates with those reported in Table 1 are because only a subsample of observations for which all relevant data are available are used for the analysis.

Source: Authors 'calculations from NSSO (68th round) and DLHS-4

Table 3: Second stage results of IV-Least Squares and IV Probit Regressions of Individual Haemoglobin Levels, Difference from thresholds and Anaemia Status (2012-13) on District Level MGNREGA Participation Rate and PDS Access Rates (2011-12).

	(1)	(2)	(3)	(4)	(5)
	IV regression Dependent variable: Haemoglobin differential (in %)	IV regression Dependent variable: ln (Haemoglobin level in gms/dl)	IV Probit model for anaemia Dependent variable (anaemia=1) IV test statistics are reported for LPM versions of this model		
			Mild or worse Anaemia	Moderate or worse Anaemia	Severe Anaemia
MGNREGA participation rate	0. 2116***	0.00291***	-0.00703***	-0.01088***	-0.01507***
Coefficients (Standard errors)	(0.018213)	(0. 000228)	(0.001564)	(0.001469)	(0.001817)
Marginal Effect at the mean			*-0.00215****	*-0.00397****	*-0.00284****
PDS participation rate	0.34703***	0. 00309***	-0.02029***	-0.01139***	-0.00483*
Coefficients (Standard errors)	(0.026950)	(0. 000341)	(0.002203)	(0.002132)	(0.002543)
Marginal Effect at the mean			*-0.00620****	*-0.00416****	*-0.00091**
MGNREGA*PDS	-0.00323***	-0. 00004***	0.00016***	0. 00015***	0.00012***
Coefficients (Standard errors)	(0.000231)	(0.000003)	(0.000019)	(0.000018)	(0.000023)
Observations	482723	482723	481715	481715	481719
Constant	-85.06216***	1.48787***	5.13965***	2.78626***	0.61732
	(8.091990)	(0.110641)	(0.62391)	(0. 590905)	(0. 740737)
Controls	Yes	yes	yes	yes	yes
Kleibergen-Paap rk LMstatistic for underidentification	2740.523***	2740.523***	640.32***	640.32***	640.32***
Kleibergen-Paap rk WaldF statistic for weakidentification	887.131***	887.131***	206.70***	206.70***	206.70***
F value for joint Significance/Wald chi-Square	220.81***	383.73***	14229.25***	27788.22***	12982.96***

Note: Standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01.All regression equations include individual, household, village, district, and state level control variables. Instruments Used: Rationing rate for MGNREGA participation, and unit price differential for wheat between PDS and market prices for PDS. For first stage results please see AppendixTable6 (IV: Haemoglobin differential and log of haemoglobin level) and Appendix Table 7 (IV Probit for different forms of anaemia).Haemoglobin differential is the percentage deviation from the minimum haemoglobin level needed to overcome anaemia for different groups, as prescribed by the WHO. Kleibergen-Paap rk Wald F statistic for weak identification exceeds the Stock-Yogo weak ID F test critical values for single endogenous regressor and independent and identically distributed observations (5% maximal IV relative bias). For IV probit, instrument validity tests are performed for a Linear Probability Model, the full LPM results are in Appendix Table 8. For detailed IV and IV probit results of all covariates, refer to Appendix Tables 9 and 10 respectively. For full list of variables included and the results, see Appendix Table 1. Also note that given the computational difficulties in computing average marginal effects, we report marginal effect at the mean participation levels in the MGNRGEA and mean access rate for the PDS.

5 Heterogeneous impacts based on severity of anaemia and programme scale

Despite the impacts suggested by the IV approach, there is reason to believe that there might possibly be threshold effects based on programme scale or differential impacts of these programmes based on the prevalence of anemia in the district. Non-parametric analyses (Figures 2, 3) do suggest significant nonlinearities across the programme scale on the one hand and severity of anaemia on the other. We therefore pose the following questions: First, does the impact of the programmes vary depending on the scale of implementation? In other words, are there specific thresholds, i.e., minimum scale of implementation that is required for these programmes to have an impact? To examine this question, we use a penalized cubic spline regression of anaemia on MGNREGA and PDS, evaluating, for each programme, the differential impact across different scales of implementation. We combine the spline regression (Equations 3a and 3b) with a control function approach to address the endogeneity of the scale of programme implementation (similar to Lee, 2007), where we use the predicted errors from the first stage equations (1a) and (1b), i.e., $\widehat{\epsilon_r}, \widehat{\epsilon_p}$ as controls. We use restricted cubic spline regressions with 5 knots defined for MGNREGA and PDS, in turn, based on Harrell (2001) as below[22]:

$$Y_{ihvdst} = \beta_0 + \sum_{i=1}^{4}\beta_{1i}MGNREGA_{d\,t-1} + \beta_2 PDS_{d\,t-1} + \beta_3 Y_{d0} + \beta_4 I_{i\,t} + \beta_5 X_{h\,t} + \beta_6 Z_{v\,t} + \beta_7 Z_{dt} + \beta_8 W_{st} + \widehat{\epsilon_p} + \widehat{\epsilon_r} + \varepsilon_a \text{ (3a)}$$

$$Y_{ihvdst} = \lambda_0 + \sum_{i=1}^{4}\lambda_{2i}PDS_{d\,t-1} + \lambda_1 MGNREGA_{d\,t-1} + \lambda_3 Y_{d0} + \lambda_4 I_{i\,t} + \lambda_5 X_{h\,t} + \lambda_6 Z_{v\,t} + \lambda_7 Z_{dt} + \lambda_8 W_{st} + \widehat{\epsilon_p} + \widehat{\epsilon_r} + \varepsilon_b \text{ (3b)}$$

A second set of questions pertains to the effectiveness of these programmes in contexts of varying degrees of anaemia. Answers to these would clarify the potential and the limits of large scale social safety nets to impact different forms of anaemia. We implement a quantile regression combining it with a control function approach, as before, to tackle endogeneity (Lee, 2007). Using estimators of the errors from equation 1(a) and 1(b), we estimate equation (4). For the conditional cumulative distribution function of Y, F(Y/**X**), the τth quantile is given by

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[22] We use five knots are based on recommendations by Harrell (2001). Cubic polynomials are estimated in each of these bounded intervals.

$Q_Y(\tau) = F_{Y/X}^{-1}(\tau)$where

$F(Y_{dt}/\boldsymbol{X}) = \lambda_0 + \lambda_1 MGNREGA_{d\,t-1} + \lambda_2 PDS_{d\,t-1} + \lambda_3 Y_{d0} + \lambda_4 I_{i\,t} + \lambda_5 X_{h\,t} + \lambda_6 Z_{v\,t} + \lambda_7 Z_{dt} + \lambda_8 W_{st} + \widehat{\epsilon_p} + \widehat{\epsilon_r}$ (4)

We estimate Model 4 for quintiles. We run both models for the percentage differential in haemoglobin levels from the WHO thresholds. As with Model 2, a positive coefficient implies that the programme has positive impacts on health and vice versa.

Figure 2: Anaemia Rates by MGNREGA scale of implementation
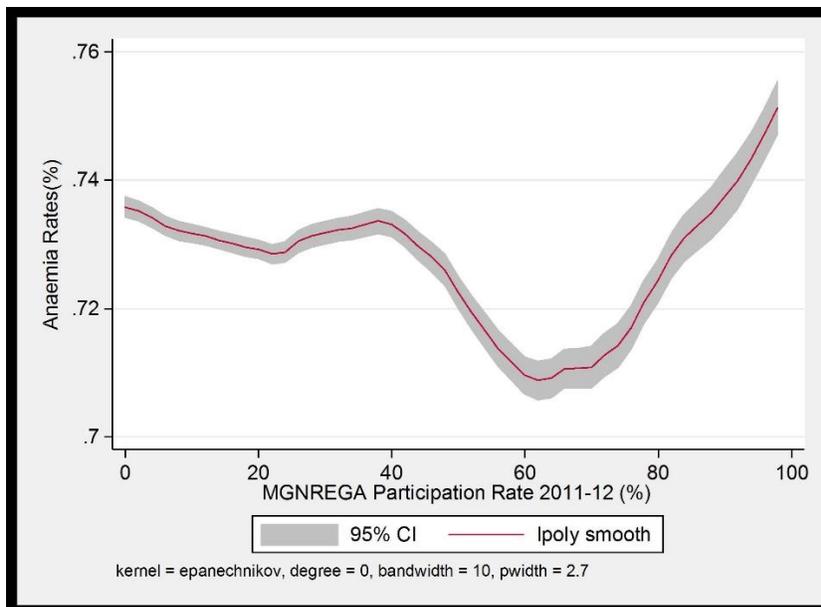
Figure 3: Anaemia Rates by PDS scale of implementation
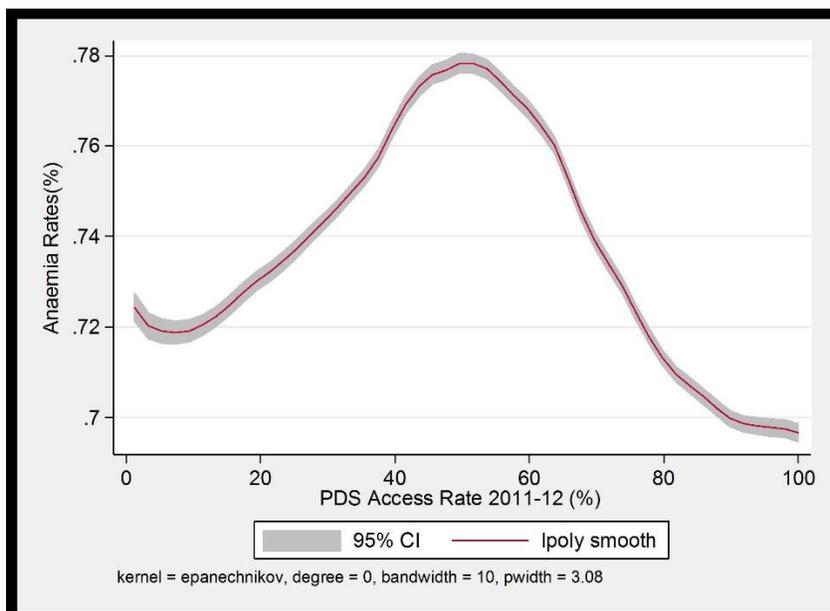
5.1. Cubic Spline Regression

The regression coefficients (Table 4) suggest that MGNREGA participation rates in the range 0 % to 5% & 17% to 34% and PDS access rates in range 12% to 34% & 65% to 86% are associated with significant improvements in difference from anaemia thresholds, respectively. Note that the pathways in the two ranges could possibly be different from each other. For example, at lower levels of improvements in PDS access rate, the improvement may come from direct cereal consumption from the PDS whereas an improvement at higher levels could possibly be attributed to diet diversity from the implicit income transfers from the food subsidy.

5.2 Quantile Regression

Results from the quantile regression (Table 5) suggest that for both programmes, expanding the scale of implementation, i.e., broader PDS reach and higher MGNREGA participation rates, have a positive impact on those who fare poorly (i.e., have larger deficits in haemoglobin relative to the threshold). For the bottom quintile, a 10 percentage point expansion in scale of implementation of the PDS can improve the threshold differential in haemoglobin level by 0.8 percentage points, while an expansion in MGNREGA participation rate can improve the differential by 1.4 percentage points. This suggests that in contexts of severe anaemia, safety nets can play a supportive, even if only a modest, role in redressing anaemia. Increased income

from the MGNREGA and the implicit income transfer from PDS may therefore make a significant dent in reducing the anaemia burden when there anaemia.

While the impact of MGNREGA remains positive and statistically strongly significant for all quintiles, its effects are most pronounced for the bottom quintile and progressively decline for others. Throughout the distribution, the MGNREGA has an impact that is much larger than that of the PDS, though the "impact" gap narrows as the threshold differential in haemoglobin levels narrows and eventually turns positive. The impact of PDS is more equivocal – though positive and statistically significant at the lowest quintile, this effect turns zero for and then negative for higher quintiles, respectively. These findings might be suggestive of a positive effect of access to cereals for those who fare poorly, with crowding out of diverse diets in districts with lower anaemia prevalence, though this might not be the only pathway. Uncovering these pathways, a task beyond the scope of this study, is critical for effective policy aimed at overcoming India's anaemia burden.

Table 4: Results from a restricted cubic spline regression with 5 knots: PDS access rate and MGNREGA participation rate using a control function approach

Dependent variable: Haemoglobin differential (in %)	
A. Splines based on MGNREGA scale of implementation (Model 3a)	**Coefficient (standard errors)**
Between 0 % and 4.68%	0.828*** (0.03573)
Between 4.68% and 17.18 %	-34.956*** (1.94330)
Between 17.18 % and 34.37%	51.100*** (2.91321)
Between 34.37% and 79.68%	-18.745*** (1.18841)
PDS access rate (2011-12)	0.0557** (0.02571)
B. Spline for PDS access rate (Model 3b)	**Coefficients (Standard errors)**
Between 12.27% and 34.26%	0.1960***(0.02769)
Between 34.26% and 64.82%	-0.6178*** (0.04933)
Between 64.82% and 86.39%	1.3499***(0. 12755)
Between 86.39% and 96.38%	-1.4064***(0.23963)
MGNREGA participation rate (2011-12)	0.1185***(0.00801)
Predicted reduced form residuals from first stage of equation 3 a	**Coefficients (Standard errors)**
Predicted PDS (2011-12) residual ($\widehat{\epsilon_p}$)	-0.0870***(0.02571)
Predicted MGNREGA (2011-12) residual ($\widehat{\epsilon_r}$)	0.0998***(0.01384)
Predicted reduced form residuals from first stage of equation 3 b	**Coefficients (Standard errors)**
Predicted PDS (2011-12) residual ($\widehat{\epsilon_p}$)	-0.0596** (0.02568)
Predicted MGNREGA (2011-12) residual ($\widehat{\epsilon_r}$)	-0.1147***(0.00914)

Notes: For full results, see Appendix Table 11. The knots for different cubic functions are based equally distanced percentiles of variable of interest's marginal distribution (Harrell, 2001).

Table 5: Quantile regression results, control function approach (Model 4)

Quantiles	Corresponding mean value of haemoglobin differential (%)	PDS	MGNREGA
0.20	-29.30	0.0829*** (0.01910)	0.1453*** (0.01225)
0.40	-17.31	0.0188 (0.01529)	0.1135*** (0.00966)
0.60	-8.06	-0.0298** (0. 01511)	0.1023*** (0. 01061)
0.80	3.81	-0.0707*** (0. 01828)	0.0857*** (0. 01182)

For full results, see Appendix Table 12. Standard errors are bootstrapped with 300 repetitions.

6 Concluding Remarks

This paper set out to examine if large-scale social safety nets can protect public health even if they do not explicitly target nutritional or health goals. The results from the analysis suggest a strong positive association between scale of programme implementation and health.

We find that increase in scale of the MGNREGA and the PDS, on average is associated with significant improvements in both the haemoglobin levels and the group wise haemoglobin deficit from the WHO recommended benchmarks. Moreover, evidence suggests that expanding the scale of PDS and MGNREGA, on average reduces incidence of anaemia of all forms – mild or worse, moderate or worse and severe anaemia. In addition, the impact of these programmes depends on scale of implementation, with both MGNREGA and PDS being particularly effective in certain thresholds and having the strongest impact for those who fare worst in terms of the gap from recommended haemoglobin benchmarks. Given the rich set of controls that are accounted for and the use of instrumental variables to achieve identification, we interpret these results as strongly suggestive of a causal relationship.

How do these compare with the impacts of targeted programmes for anaemia? Although significant methodological challenges prevent credible comparisons of cost-benefit ratios, the MGNREGA and especially the PDS compare favourably with targeted anaemia interventions that have modest impacts[23]. Early studies in India of interventions administering elemental iron in salt (for 12-18months) and B12, folate and iron tablets for pregnant women (22 weeks) for 3 months suggest increase in the range of 3-7% in southern cities (32-35% in Kolkata) for the former and 13-15% for the latter intervention, with higher responsiveness of females. Overall the range of haemoglobin levels increase range from 0.5 to 3.1gm/dl (Levin, 1986). More recent studies in rural settings of programmes targeting adolescent girls point to decrease in severe anaemia by at most 5.4% in Maharashtra to over 70% in Uttar Pradesh with increases in moderate and mild anaemia. These are achieved at Rs.5-Rs.357 per girl per year at 2000-2005 nominal prices (UNICEF, 2011). The impacts on anaemia associated with social safety nets are therefore comparable with interventions that have a modest impact. [24]

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[23] We note here that the modest impact of iron folate supplements on anaemia could possibly be attributed to supply sided considerations like low coverage, supply chain bottlenecks among others and does not suggest ineffectiveness of the programme per se.

[24] The cost of the MGNREGA is Rs.178.02/ person day in 2011-12 at current prices and works out to Rs.7548.25 /household assuming an average of 42 days/ household per year. The PDS costs Rs.188.34/kg/household/per year and the implicit cost is Rs.4011.69 per household per year at current prices assuming 21.3 kg per year per household (total foodgrains and all categories of households). Given that these programmes do not explicitly target anaemia and have multiple objectives it is hard to obtain sensible estimates of cost-benefit ratios specifically for anaemia impacts.

There are a number of caveats to the work. First it does not account for intensity of participation. Second, it cannot distinguish between the benefits to participants vis-à-vis non-participants. Third, it does not uncover the specific pathways through which these effects manifest. While these remain limitations of the work, these findings emphasize the possibility that social safety nets can support public health even when they do not explicitly target them. The findings also point to the need for more research in this area, that would help us to better understand the pathways through which social safety nets impact health and where explicit efforts can be made to link these programmes to health outcomes.

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Supplementary Materials

Appendix Table 1: List of Variables used in the Analysis

Variable	Source and Details	Remarks
Rainfall in the district	NASA	Cumulative deviation for the period 2004 to 2013 taken from the average rainfall for the period 2001 to 2015
Per capita real development expenditure per person for states	EPWRF (cumulatively taken for 2002-2013). Census data from 2001 and 2011 used to interpolate population for states and 2004-05 serves as base year	Expenditure was in lakhs, population was converted into lakh and per capita values were computed
Per capita net state domestic product at constant prices	Handbook of Statistics on Indian States, Reserve bank of India, units are rupee	Average figures taken for the period 2002-2013
Annual growth of per capita net state product at constant prices	Handbook of Statistics on Indian States, Reserve bank of India, 2004 to 2013	
MGNREGA leakage	2011-2012 figures from Imbert, C., & Papp, J. (2015)	
PDS leakage	2011-2012 figures from Dreze, J., & Khera, R. (2015)	
Percentage delay in MGNREGA payments	Mahatma Gandhi National Rural Employment Guarantee Act (2005) website. nrega.nic.in, MIS report for 2012-2013	Share of delayed payments in overall wage payments
NSS data (68th Round 2011-12) and district level controls		
MGNREGA participation rate district	NSS 68th round, MOSPI	Proportion of households who worked
MGNREGA Rationing rate	NSS 68th round, MOSPI	Proportion of wage seeker-households who were not provided work
Unit price of wheat/rice	NSS 68th round, MOSPI	Value divided by quantity of consumption
PDS use	NSS 68th round, MOSPI	Whether or not the household bought grain from the PDS
PDS access rate district	NSS 68th round, MOSPI	Proportion of households with access to PDS
Proportion of poor people in the district	NSS 68th round, MOSPI	Proportion of people below poverty line in 2011-12
MGNREGA implemented in phase-I, phase-II or phase-III, IAP districts	Mahatma Gandhi National Rural Employment Guarantee Act (2005) website. nrega.nic.in	

Health and Nutritional Status Data (DLHS-4 2012-2014)		
Outcome Variables		
Haemoglobin count (Individual)	DLHS-4 (select states)	Only for those who gave consent
Body Mass Index	DLHS-4 (select states)	Only for those who gave consent
Factor variables from DLHS-IV		
Proportion of those with mild, moderate and severe anaemia	DLHS-4 (select states)	Anaemia defined as per the WHO standards. Benchmarks different for children in age group: below 5, 5-11 years, 12-14 years, non-pregnant women, pregnant women and men above 15 years of age
Household and individual controls	DLHS-4 (select states)	Variables include religion, social group, gender, age, asset and land ownership, type of house, source of water and toilet, drainage facility, occupation, education, land ownership, vocational training, chronic illness, personal habits (chew/smoke/drink)
Village Level Controls	DLHS-4 (select states)	Variables include distance to nearest bus stop, all weather road to PHC, ICDS centre, PHC, medical practitioner in village govt. dispensary, bank, SHG ,implementation of JSY/MDM/ICDS/Sanitation Programme/RG Drinking Water Mission/GRY
Anaemia Data (DLHS-2 2002-2004)		
Anaemia rates 2002-2004	DLHS-2	Mild, moderate and severe anaemia for children

Appendix Table 2:Summary Statistics of Control Variables used in the analysis

Control variables	Mean	Standard Deviation
Age of individual tests for CAB (2012-13)	32.886	19.859
Female share in household (2012-13)	49.865	16.562
Gender		
Male respondents	46.580	
Female respondents	53.410	
Caste		
Scheduled Castes and Scheduled Tribes	42.750	
Other backward classes	33.810	
Others	19.440	
Maritial status		
Married	64.200	
Unmarried	23.190	
Share of pregnant respondents	2.98	
Wealth Index using PCA for assets (0-100)	58.745	22.719
House type		
Pakka	35.580	
Others	64.360	
Toilet type		
Open	39.960	
Improved	55.100	
Unimproved	4.460	
Access to water		
Improved	90.430	
Unimproved	9.120	
Cooking fuel		
indoor air polluting sources	71.910	
non indoor polluting sources	28.030	
Land ownership (%)	47.440	
Chronic Illnesses		
Inflammatory anaemia (%)	0.720	
all other chronic illnesses	8.870	
Education		
illiterate	1.170	
literate without formal education	1.880	
literate formal edu:upto class X	52.750	
literate formal edu: >=higher secondary	12.520	
no response	31.680	
Education of head		
illiterate	0.260	
literate without formal education	0.470	
literate formal edu:upto class X	55.420	
literate formal edu: >=higher secondary	39.450	
no response	4.390	
Occupation (%)		
Administration, executive, manager	0.590	
Clerk	1.430	
Service staff	3.260	
Cultivator	10.680	
Agricultural labour	10.570	
Forest, fishing, mining	0.880	

Control variables	Mean	Standard Deviation
Skilled labour	10.120	
None of the above	57.300	
Occupation of head (%)		
Administration, executive, manager	1.300	
Clerk	3.130	
Service staff	7.330	
Cultivator	25.000	
Agricultural labour	18.740	
Forest, fishing, mining	2.120	
Skilled labour	22.450	
None of the above	18.830	
Personal habits		
Chewing tobacco		
Never	51.250	
Pan:with or without tobacco	9.550	
Gutka:with or without tobacco	2.280	
Only tobacco	3.470	
exchewer	1.180	
not known or not responded	32.260	
Smoking		
Never	58.390	
Any smoker	9.270	
Not known or not respond	32.340	
Alcohol consumption		
never	56.380	
usual or ocassional	9.430	
ex drinker	1.810	
not known or not respond	32.390	
Village facilities		
Self Help Group	74.490	
ICDS	98.200	
PHC	22.290	
Govt dispensary	10.480	
Bank branch	32.350	
Any medical practitioner in village	98.610	
Any health facility in village	72.550	
Medical practitioner per person	0.005	0.007
Distance to nearest bus station (km)	8.726	16.745
All weather road to PHC	82.920	
Schemes implemented in village		
Janani Suraksha Yojana	93.140	
Mid Day Meal	87.910	
Integrated Child Development Services	86.340	
Sanitation programme	57.840	
RG drinking water mission	25.790	
Gram Rozgar Yojana	29.470	
Mild anaemia in children (DLHS-2, 2002-2004)	40.977	18.654
Moderate anaemia in children (DLHS-2, 2002-2004)	35.203	18.009
Severe anaemia in children (DLHS-2, 2002-2004)	2.882	3.466
Percent of Integrated Action Plan districts	3.040	
Percent in districts covered in phase1 of MGNREGA	25.670	

Control variables	Mean	Standard Deviation
Percent in districts covered in phase2 of MGNREGA	21.420	
Proportion of poor, BPL (2011-12)	29.930	15.241
Per capita real development expenditure (2002-2013)	60031.770	33477.550
Delay in payments in MGNREGA (2011-12)	40.645	36.413
Total positive deviation in rainfall	49.429	4.041
Absolute negative deviation in rainfall	45.660	3.822
PDS leakage 2011-12	35.706	19.864
MGNREGA leakage 2011-12	67.350	33.636
Per capita net state domestic product at factor cost 2013 (pc nsdp fc)	51683.070	11867.460
Mean growth rate of pc nsdp fc 2005-2013	6.688	1.540

Source: Authors 'calculations from NSSO (68th round) and DLHS-4

Appendix Table 3: Grouping of variables

Variables	Original as in data	Edited groups
Pregnancy status	Pregnant (1), lactating (2), pregnant and lactating (3), not pregnant (4), not lactating (5), not pregnant and not lactating (6)	Pregnant (1,2,3) and not pregnant (4,5,6)
Source of water	Piped water (1), public/standing tap (2), hand pump (3), tube well or borehole (4), protected dug well (5), unprotected dug well (6), Protected spring (7), unprotected spring (8), rainwater collection (9), tanker (10), cart with small tank (11), surface water (12), packaged water (13), other sources (96)	Improved sources (1,2,3,4,5,7,9), unimproved sources (8,10,11,12,13), others (96)
Toilet	Flush to piped sewer (11), flush to septic tank(12), flush to pit latrine (13), flush to somewhere else (14), flush don't know where (15), pit ventilated improved bio-gas latrine (21), pit latrine with slab (22), pit latrine without slab (23), twin pit composting (31), dry/service latrine (41), open spaces (51), other (96)	Open (51), Improved sources (11,12,13,21,22,31), unimproved sources (14,15,23,41), others (96)
House type	Pakka (1), semi- pakka (2), kacha (3) and others (6)	Pakka (1), others (2,3,6)
Cooking fuel	Firewood (1), crop residue (2). Cow dung cake (3), coal/lignite/charcoal (4), kerosene (5), LPG/PNG (6), electricity (7), biogas (8), no cooking (9), any other (96)	Indoor air polluting sources (1,2,3,4), non-indoor polluting sources (6,7,8,9,96)
Chronic illness	Diabetes (1), hypertension (2), chronic heart Disease (3), myocardial infection/heart attack, (4)stroke cerebro vascular accident(5), epilepsy (6), chronic respiratory failure(7), thyroid disorder(8), tuberculosis(9), leprosy (10), cancer – respiratory system (11), cancer- gastrointestinal system (12), cancer- genitourinary system (13), cancer – breast (14), renal stone (15), others (hernia, Hydrocele, peptic ulcer, etc) (99), not diagnosed (0), chronic renal diseases (16), gall stone/ cholecystitis (17), chronic liver diseases(18), rheumatoid arthritis (19), chronic skin disease/ psoriasis (20), cataract (21), glaucoma (22), sinusitis, tonsillitis (23), flourosis (24), pyorrhoea (25), rheumatic fever/heart diseases (26), tumor (27), leukemia (28), skin cancer (29), piles,anal fisure, anal fistula (30), anaemia (31), none (96)	all other chronic illnesses, inflammatory anaemia : gastrointestinal (5), none (96)
Highest level of education	Literate without formal education (1), **formal :** below primary (2), primary (4), middle (4), secondary (5), higher secondary (6), graduate (7), post graduate (8), illeterate (0)	Illiterate (0), literate without formal (1), literate, formal up to secondary (2,3,4,5), literate, formal, higher secondary and above (6,7,8)
Chewing habits	Pan with tobacco (1), pan without tobacco (2), gutka / pan masala with tobacco (3), gutka / pan	Never chewed (7), pan : with or without

Variables	Original as in data	Edited groups
Pregnancy status	Pregnant (1) , lactating (2), pregnant and lactating (3) , not pregnant (4), not lactating (5), not pregnant and not lactating (6)	Pregnant (1,2,3) and not pregnant (4,5,6)
Source of water	Piped water (1), public/standing tap (2), hand pump (3), tube well or borehole (4), protected dug well (5) , unprotected dug well (6), Protected spring (7), unprotected spring (8), rainwater collection (9), tanker (10), cart with small tank (11), surface water (12), packaged water (13), other sources (96)	Improved sources (1,2,3,4,5,7,9), unimproved sources (8,10,11,12,13), others (96)
Toilet	Flush to piped sewer (11), flush to septic tank(12), flush to pit latrine (13), flush to somewhere else (14), flush don't know where (15), pit ventilated improved bio-gas latrine (21), pit latrine with slab (22), pit latrine without slab (23), twin pit composting (31), dry/service latrine (41), open spaces (51), other (96)	Open (51), Improved sources (11,12,13,21,22,31), unimproved sources (14,15,23,41), others (96)
House type	Pakka (1), semi- pakka (2), kacha (3) and others (6)	Pakka (1), others (2,3,6)
Cooking fuel	Firewood (1), crop residue (2). Cow dung cake (3), coal/lignite/charcoal (4), kerosene (5), LPG/PNG (6), electricity (7), biogas (8), no cooking (9), any other (96)	Indoor air polluting sources (1,2,3,4), non-indoor polluting sources (6,7,8,9,96)
	masala without tobacco (4), only tobacco (5), ex-chewer (6), never chewed (7), not known (8) , not respond (99)	tobacco (1,2), gutka : with or without tobacco (3,4), only tobacco (5), ex-chewer (6), not known or not responded (8,99)
Smoking/drinking habits	Usual smoker (1), occasional smoker (2), ex-smoker (3), never smoked (4), not known (8), not respond (99)	Never smoke (4), any smoker(1,2,3), not known or not responded (8,99)
Drinking habits	Usual drinker (1), occasional drinker (2), ex-drinker (3), never (4), not known (8), not respond (99)	Never drank (4),usual or occasional (1,2), ex drinker (3), not known or not responded (8,99)

Note: Access to water and toilet categorisation based on World Health organisation and United Nations Children's Fund's Joint Monitoring Programme (JMP) for Water Supply and Sanitation recommendations. For chronic illnesses, we distinguish between intestinal infection and all other chronic illnesses as gastrointestinal infections is a major cause of anaemia (inflammatory) as against nutritional anaemia

Appendix Table 4: State-wise anaemia rates under NFHS 3, NFHS 4 and DLHS 4

States	Total Anaemia Rates NFHS-4 2015-16 (%)			Total Anaemia Rates DLHS-4 2012-13 (%)			Total Anaemia Rates NFHS-3 2005-06 (%)			MGNREGA participation rate (2011-12)	PDS access rate (2011-12)
	Children (6-59 months)	Pregnant Women 15-49 years	All Women 15-49 years	Children (6-59 months)	Pregnant Women 15-49 years	All Women 15-49 years	Pregnant Women 15-49 years	Children (6-59 months)	All Women 15-49 years		
Andaman and Nicobar	49.0	61.4	65.7	78.1	73.0	70.1				23.2	82.8
Andhra Pradesh	58.6	52.9	60.0	79.2	71.5	68.1	58.2	70.8	62.9	32.6	88.5
Arunachal Pradesh				64.0	61.7	56.7	51.8	56.9	50.6	36.4	51.8
Assam	35.7	44.8	46.0				72.0	69.6	69.5	23.2	53.8
Bihar	63.5	58.3	60.3				60.2	78.0	67.4	10.5	46.6
Chandigarh				57.6	44.6	47.7					9.0
Goa	48.3	26.7	31.3	72.9	61.0	63.4	36.9	38.2	38.0	4.1	71.9
Haryana	71.7	55.0	62.7	62.8	59.6	57.7	69.7	72.3	56.1	4.6	17.6
Himachal Pradesh				58.6	43.0	44.0	39.2	54.7	43.3	33.4	90.8
Karnataka	60.9	45.4	44.8	75.9	64.6	62.5	60.4	70.4	51.5	9.9	77.1
Kerala				48.5	34.6	32.7	33.8	44.5	32.8	18.7	83.3
Madhya Pradesh	68.9	54.6	52.5				57.9	74.1	56.0	20.6	41.6
Maharashtra	53.8	49.3	48.0	73.7	69.5	65.3	57.8	63.4	48.4	4.9	49.2
	23.9	26.0	26.4	72.4	71.5	65.3	36.4	41.1	35.7		

States	Total Anaemia Rates NFHS-4 2015-16 (%)			Total Anaemia Rates DLHS-4 2012-13 (%)			Total Anaemia Rates NFHS-3 2005-06 (%)			MGNREGA participation rate (2011-12)	PDS access rate (2011-12)
	Children (6-59 months)	Pregnant Women 15-49 years	All Women 15-49 years	Children (6-59 months)	Pregnant Women 15-49 years	All Women 15-49 years	Pregnant Women 15-49 years	Children (6-59 months)	All Women 15-49 years		
Manipur										74.4	6.2
Meghalaya	48.0	53.1	56.2	70.7	63.9	53.9	60.2	64.4	47.2	67.0	67.8
Mizoram				70.7	63.2	64.1	51.7	44.2	38.6	93.9	97.6
Nagaland				61.3	54.4	50.2				85.9	19.2
Puducherry	44.9	26.0	52.4	57.9	53.2	52.2				25.6	83.0
Punjab				65.8	58.0	52.7	41.6	66.4	38.0	7.3	24.9
Sikkim	55.1	23.6	34.9	82.9	74.9	70.6	62.1	59.2	60.0	58.3	61.0
Tamil Nadu	50.7	44.4	55.1	60.2	55.5	49.2	54.6	64.2	53.2	40.1	93.9
Tripura	48.3	54.4	54.5	51.1	37.2	45.6	57.6	62.9	65.1	77.4	86.2
Uttaranchal	59.8	46.5	45.2				50.8	61.4	55.2	27.7	70.6
West Bengal	54.2	53.6	62.5	86.4	79.2	76.3	62.6	61.0	63.2	38.3	51.8
Telangana	60.7	49.8	56.7	71.0	61.9	57.7					

Source: NFHS-3, NFHS-4 and DLHS-4 state fact sheets and NSS 68th round (2011-12)

Appendix Table 5: Haemoglobin levels to diagnose anaemia at sea level (g/dl)+/-

Population	No anaemia	Mild	Moderate	Severe
Children 6 -59 months of age	11 or higher	10-10.9	7-9.9	lower than 7
Children 5 -11 years of age	11.5 or higher	11-11.4	8-10.9	lower than 8
Children 12 -14 years of age	12 or higher	11-11.9	8-10.9	lower than 8
Non-pregnant women (>=15 years of age)	12 or higher	11-11.9	8-10.9	lower than 8
Pregnant women	11 or higher	10-10.9	7-9.9	lower than 7
Men (>=15 years of age)	13 or higher	11-12.9	8-10.9	lower than 8

+/- Adapted from reference 5 and 6

Haemoglobin is in grams per decilitres

Mild is a misnomer: iron deficiency is already advanced by the time anaemia is detected. The deficiency has consequences even when no anaemia is clinically apparent

Source: FAO, WHO. *World Declaration and Plan of Action for Nutrition. International Conference on Nutrition*. Rome, Food and Agriculture

Organisation of the United Nations, December 1992. Available at http://whqlibdoc.who.int/hq/1992/a34303.pdf

WHO, UNICEF, UNU. *Iron deficiency anaemia: assessment, prevention and control, a guide for programme managers.* Geneva, World Health

Organisation, 2001. Available at

http://www.who.int/nutrition/publications/micronutrients/anaemia_iron_deficiency/WHO_NHD_01.3/en/index.html

Appendix Table 6: First stage regressors for IV

First Stage IV Least Squares Regression: Effect of MNREGA Participation and PDS Access on Hameoglobin levels and differentials

	(1) MGNREGA participation rate	(2) PDS access rate
MGNREGA rationing rate (2011-2012)	-7.23748***	-10.68161***
	(0.159102)	(0.268869)
Unit price difference for wheat (2011-2012)	0.74803***	0.22421***
	(0.007658)	(0.008231)
MGNREGA rationing rate*Unit price difference for wheat(2011-2012)	-0.92879***	0.77800***
	(0.015254)	(0.024779)
IAP district (Ref. no)	2.28870***	8.13966***
	(0.072061)	(0.087947)
MGNREGA implemented in phase-1 (Ref. no)	2.34208***	2.75636***
	(0.041464)	(0.060414)
MGNREGA implemented in phase-2 (Ref. no)	3.52761***	4.08562***
	(0.041623)	(0.065847)
Mild anaemia % in children DLHS 2	0.03938***	0.07477***
	(0.001264)	(0.002060)
Moderate anaemia % in children DLHS 2	0.07164***	-0.15144***
	(0.001418)	(0.002297)
Severe anaemia % in children DLHS 2	0.28353***	0.19918***
	(0.004784)	(0.007789)
Proportion of poor in district	1.97392***	-7.14706***
	(0.133872)	(0.203671)
Gender (Ref. Male) : Female	0.04510	-0.01474
	(0.065173)	(0.099314)
Other	-4.01237	-6.97647***
	(3.260381)	(1.030861)
Social Group (Ref: others): Scheduled Caste	-0.12729***	-1.83434***
	(0.041084)	(0.068509)
Social Group (Ref: others): Scheduled Tribes	-0.32008***	-0.57484***
	(0.057065)	(0.089977)
Other Backward Classes	-0.48050***	-0.57473***
	(0.037720)	(0.065131)
Marital status (Ref. no response): Married	-0.17510	-0.14459
	(0.106540)	(0.161196)
Unmarried	-0.24239***	-0.85449***
	(0.093465)	(0.142296)
Pregnancy status (Ref. not pregnant): Pregnant	0.61004	-0.29705
	(1.419081)	(1.999294)
Age in years	-0.00097	0.02703***
	(0.001267)	(0.001916)
Source of water (Ref. unimproved): improved source	-0.78265***	-4.25140***
	(0.055651)	(0.086742)
Nature of toilet (Ref. open): Improved	-0.26622***	-0.39644***
	(0.036202)	(0.055945)
Unimproved	1.43549***	0.08947
	(0.098207)	(0.137143)
Other	2.57728***	-1.67307***
	(0.250485)	(0.409414)

	(1)	(2)
House type (Ref. others): Pakka	-0.79190***	-1.88145***
	(0.033528)	(0.049314)
others	0.00000	0.00000
	(.)	(.)
Cooking fuel (Ref. air polluting sources): Non indoor polluting sources	-1.47456***	-0.50462***
	(0.037572)	(0.053325)
Female share in Household	-0.00202**	0.00397***
	(0.000966)	(0.001395)
Land ownership (Ref. No) : Yes	0.24368***	2.32012***
	(0.033773)	(0.050070)
no	0.00000	0.00000
	(.)	(.)
Wealth Index (0-100)	0.00648***	0.05772***
	(0.000871)	(0.001370)
Chronic Illness (Ref. None): all other chronic illnesses	-0.15886***	-1.17070***
	(0.049924)	(0.079067)
Inflammatory anaemia: gastrointestinal	-1.45989***	-1.83602***
	(0.173087)	(0.283103)
Education level (Ref. illiterate): Literate without formal education	2.79385***	0.72119***
	(0.182575)	(0.206655)
Literate formal: up to class X	2.44398***	1.92799***
	(0.145393)	(0.144291)
Literate formal: higher secondary and above	2.29938***	2.08925***
	(0.153129)	(0.160085)
Education level of HH head (Ref. illiterate): literate without formal education	-0.98059***	-0.30773
	(0.366155)	(0.423689)
Literate formal: up to class X	-0.44263	0.42387
	(0.271787)	(0.272178)
Literate formal: higher secondary and above	-0.52716*	0.56729**
	(0.272821)	(0.274324)
Occupation(Ref. no): Administration, executive or manager	-0.46247*	-0.27065
	(0.241541)	(0.311456)
Clerk	-0.01119	0.34218
	(0.151178)	(0.216686)
Service Staff	0.20125*	0.34499**
	(0.111809)	(0.160279)
Cultivator	0.52625***	0.24323*
	(0.097275)	(0.139966)
Agricultural labor	0.48520***	0.75966***
	(0.094238)	(0.136818)
Forest, fishing and mining	0.09962	0.05918
	(0.166026)	(0.242775)
Skilled labor	0.51040***	0.87958***
	(0.089516)	(0.129031)
Occupation of head (Ref. no): Administration, executive or manager	-0.31172*	-0.15010
	(0.164617)	(0.214482)
Clerk	-0.24004**	0.98307***
	(0.103766)	(0.150970)
Service staff	-0.06551	0.09731
	(0.078832)	(0.113822)
Cultivator	-0.13411*	-0.79751***
	(0.072779)	(0.104250)
Agricultural laborer	-0.23255***	0.46912***
	(0.072603)	(0.105629)
Forest, fishing and mining	0.33273***	-0.13518

	(1)	(2)
	(0.107524)	(0.159474)
Skilled labor	-0.69063***	-0.34857***
	(0.066255)	(0.096048)
Village availability (Ref. no response): SHG	10.23285***	-5.28557***
	(0.992000)	(0.444697)
No SHG	9.29638***	-7.03115***
	(0.992799)	(0.449029)
ICDS	-6.69859***	-12.09474***
	(0.700723)	(1.013740)
No ICDS	-2.80502***	-7.76534***
	(0.728818)	(1.052994)
PHC	-2.83137***	5.13030***
	(0.373264)	(0.491702)
No PHC	-2.91262***	4.00963***
	(0.370674)	(0.487963)
Government dispensary	-1.06932***	0.37090
	(0.162452)	(0.562022)
No government dispensary	-0.08358	3.22787***
	(0.157248)	(0.559426)
Bank	-16.40213***	6.68719***
	(0.960166)	(0.315283)
No Bank	-15.65358***	6.41231***
	(0.959732)	(0.312819)
Chewing habits (Ref. never chewed) Pan: with or without tobacco	2.01939***	2.88105***
	(0.061834)	(0.091602)
Gutka: with or without tobacco	0.54506***	1.63138***
	(0.098067)	(0.150568)
Only tobacco	0.14354	0.95058***
	(0.090802)	(0.136865)
Ex-chewer	-0.35118**	0.45545**
	(0.163456)	(0.225998)
Smoking habits (Ref. never smoked):any smoker	1.84680***	2.00594***
	(0.074319)	(0.102941)
Drinking habits (Ref. never drank): usual or occasional	-2.62546***	-4.97615***
	(0.074158)	(0.102886)
Ex-drinker	-0.34954***	-1.83907***
	(0.132788)	(0.183448)
Medical practitioner in village (Ref. no) : yes	-5.62367***	0.80420**
	(0.342443)	(0.382658)
Medical practitioner per person in village	-3.65707	79.46355***
	(2.416893)	(3.696980)
Any health facility in village (Ref. no): yes	-0.32837***	0.78818***
	(0.036328)	(0.055999)
Distance of nearest bus station (km)	0.07980***	0.02511***
	(0.002724)	(0.001849)
All weathered road to PHC (Ref. no): yes	-0.93979***	-2.59022***
	(0.044410)	(0.065431)
Schemes implemented in village (Ref. no): JSY	-1.90926***	1.91945***
	(0.092468)	(0.110334)
MDM (Ref. no): yes	-0.77348***	-0.05095
	(0.053880)	(0.074812)
ICDS (Ref. no): yes	0.18407***	0.93026***
	(0.052368)	(0.070462)
Sanitation programme (Ref. no): yes	0.66598***	2.86770***
	(0.030989)	(0.047007)

	(1)	(2)
RG drinking water (Ref. no): yes	-0.46024***	-2.35565***
	(0.035487)	(0.055662)
Gram Rozgar Yojana (Ref. no): yes	0.80977***	1.95182***
	(0.033169)	(0.052773)
Per capita real development expenditure	0.00001***	-0.00000
	(0.000002)	(0.000002)
Percentage delay in MGNREGA payments (0-100)	0.01367***	0.07808***
	(0.000682)	(0.001040)
Total positive deviation in rainfall	-0.67916***	-0.24403***
	(0.004923)	(0.006406)
Absolute value of total negative deviation in rainfall	0.48197***	-0.85463***
	(0.006377)	(0.009206)
PDS leakage (2011-2012)	-0.01315***	-0.85490***
	(0.002893)	(0.003323)
MGNREGA leakage (2011-2012)	-0.27996***	-0.25765***
	(0.000885)	(0.001519)
Per capita net state domestic product at factor cost and constant prices	-0.00031***	-0.00027***
	(0.000002)	(0.000004)
Growth in Per capita net state domestic product at factor cost and constant prices	1.09690***	1.66559***
	(0.029889)	(0.031812)
Group (Ref. Children below 5) Children 5-11 years	-0.73373***	-1.62327***
	(0.122458)	(0.179754)
Children 12-14 years	-0.66564***	-1.62706***
	(0.156157)	(0.233037)
Non-pregnant women (15 years of age and above)	0.50120***	-0.88249***
	(0.157623)	(0.234733)
Pregnant women	-0.67943	-1.46940
	(1.425857)	(2.009711)
Men (15 years of age and above)	0.64157***	-0.79715***
	(0.155053)	(0.231649)
Constant	67.83479***	164.76795***
	(0.960490)	(1.444738)
Observations	481723	481723

Notes: Based on authors 'calculations

Appendix Table 7: First stage regressors for IV Probit

First stage Results of IV probit regressions: Marginal effects of MNREGS Participation and PDS Access on probaiity of anaemia of different forms

	(1) MGNREGA participation rate (2011-2012)	(2) PDS access rate (2011-2012)	(3) MGNRPDS
IAP district (Ref. no)	2.28870***	8.13967***	278.98265***
	(0.141999)	(0.175874)	(14.258578)
MGNREGA implemented in phase-1	2.34218***	2.75635***	252.33480***
(Ref. no)	(0.084411)	(0.124748)	(8.552818)
MGNREGA implemented in phase-1	3.52762***	4.08562***	406.64283***
(Ref. no)	(0.083896)	(0.133112)	(8.479588)
Mild anaemia % in children DLHS 2	0.03938***	0.07477***	2.37081***
	(0.002602)	(0.004255)	(0.252254)
Moderate anaemia % in children DLHS 2	0.07164***	-0.15144***	6.60647***
	(0.002812)	(0.004673)	(0.261730)
Severe anaemia % in children DLHS 2	0.28352***	0.19919***	19.31474***
	(0.009747)	(0.016268)	(0.904337)
Proportion of poor in district	1.97421***	-7.14707***	-188.52553***
	(0.274978)	(0.411968)	(29.534824)
Gender (Ref. Male) : Female	0.04505	-0.01488	8.17567
	(0.053734)	(0.081950)	(5.518898)
Other	0.00000	0.00000	0.00000
	(.)	(.)	(.)
Social Group (Ref: others): Scheduled Caste	-0.12723	-1.83434***	-55.02853***
	(0.081650)	(0.140643)	(7.996905)
Social Group (Ref: others): Scheduled Tribes	-0.32030***	-0.57485***	-34.35897***
	(0.113372)	(0.182445)	(12.057001)
Other Backward Classes	-0.48047***	-0.57473***	-83.73108***
	(0.075156)	(0.134337)	(7.364196)
Marital status (Ref. no response): Married	-0.17527*	-0.14455	-36.92775***
	(0.104539)	(0.157179)	(10.665460)
Unmarried	-0.24257***	-0.85447***	-39.17157***
	(0.089371)	(0.136785)	(9.123943)
Pregnancy status (Ref. not pregnant): Pregnant	0.61027	-0.29695	28.87708
	(1.418977)	(2.059008)	(145.236915)
Age in years	-0.00097	0.02703***	0.76919***
	(0.001424)	(0.002125)	(0.144353)
Source of water (Ref. unimproved): improved source	-0.78268***	-4.25137***	-186.15089***
	(0.114508)	(0.180087)	(12.496838)
Other	0.78109	-0.41397	12.00449
	(0.494490)	(0.848538)	(46.843932)
Nature of toilet (Ref. open): Improved	-0.26606***	-0.39643***	9.70466
	(0.072269)	(0.113936)	(7.042626)
Unimproved	1.43556***	0.08947	249.00330***
	(0.199663)	(0.278743)	(21.821680)
Other	2.57729***	-1.67307**	75.08869*
	(0.493853)	(0.827138)	(44.370797)
House type (Ref. others): Pakka	-0.79204***	-1.88146***	-92.68094***
	(0.067573)	(0.102032)	(6.634180)
Cooking fuel (Ref. air polluting sources):	-1.47454***	-0.50461***	-165.81281***

	(1)	(2)	(3)
Non indoor polluting sources	(0.075234)	(0.108912)	(7.470817)
Female share in Household	-0.00202	0.00397	-0.47441***
	(0.001706)	(0.002489)	(0.173873)
Land ownership (Ref. No) : Yes	0.24361***	2.32012***	36.75641***
	(0.067684)	(0.101319)	(7.011165)
Wealth Index (0-100)	0.00647***	0.05772***	-0.56265***
	(0.001795)	(0.002848)	(0.177362)
Chronic Illness (Ref. None): all other	-0.15887***	-1.17071***	-44.10588***
chronic illnesses	(0.057889)	(0.091469)	(5.633889)
Inflammatory anaemia: gastrointestinal	-1.45990***	-1.83602***	-179.57247***
	(0.182081)	(0.303160)	(17.152342)
Education level (Ref. illiterate): Literate	2.79381***	0.72119***	280.65689***
without formal education	(0.234679)	(0.262733)	(23.724796)
Literate formal: up to class X	2.44393***	1.92800***	269.93801***
	(0.192352)	(0.190474)	(19.334967)
Literate formal: higher secondary and above	2.29943***	2.08927***	257.77802***
	(0.197644)	(0.202451)	(19.814632)
Education level of HH head (Ref.	-0.98061*	-0.30772	-113.18391*
illiterate): literate without formal education	(0.578875)	(0.673712)	(58.586142)
Literate formal: up to class X	-0.44262	0.42388	-44.27392
	(0.416002)	(0.415932)	(41.502962)
Literate formal: higher secondary and	-0.52726	0.56730	-66.58824
above	(0.418339)	(0.421444)	(41.726755)
Occupation(Ref. no): Administration,	-0.46245**	-0.27065	-64.70569***
executive or manager	(0.203737)	(0.264332)	(19.889687)
Clerk	-0.01117	0.34218*	7.58107
	(0.131146)	(0.192798)	(13.281826)
Service Staff	0.20129**	0.34499**	19.07840*
	(0.100033)	(0.148223)	(10.119961)
Cultivator	0.52630***	0.24322*	55.26173***
	(0.092174)	(0.135971)	(9.444595)
Agricultural labor	0.48517***	0.75967***	66.39183***
	(0.091363)	(0.137475)	(9.142426)
Forest, fishing and mining	0.09965	0.05922	7.11510
	(0.147855)	(0.214285)	(14.523308)
Skilled labor	0.51041***	0.87953***	62.10663***
	(0.084199)	(0.124158)	(8.481761)
Occupation of head (Ref. no):	-0.31174	-0.15009	-38.01506
Administration, executive or manager	(0.320497)	(0.405177)	(33.239797)
Clerk	-0.24008	0.98309***	-30.02978
	(0.195461)	(0.295139)	(20.062143)
Service staff	-0.06552	0.09734	-19.79006
	(0.151276)	(0.221397)	(15.485284)
Cultivator	-0.13409	-0.79746***	-30.94809**
	(0.141829)	(0.203607)	(14.673643)
Agricultural laborer	-0.23240*	0.46914**	-28.63730**
	(0.139988)	(0.206148)	(14.169204)
Forest, fishing and mining	0.33272	-0.13520	-16.26779
	(0.209448)	(0.306691)	(20.685687)
Skilled labor	-0.69065***	-0.34850*	-48.07947***
	(0.128204)	(0.187229)	(13.161804)
Village availability (Ref. no response):	10.23309***	-5.28551***	527.09415***
SHG	(1.859213)	(0.832930)	(152.034675)
No SHG	9.29665***	-7.03105***	416.15759***
	(1.861084)	(0.842607)	(152.236516)

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	(1)	(2)	(3)
ICDS	-6.69892***	-12.09495***	369.30421***
	(1.235644)	(1.795499)	(121.947984)
No ICDS	-2.80543**	-7.76558***	839.94843***
	(1.300752)	(1.886618)	(130.412330)
PHC	-2.83136***	5.13030***	-493.74575***
	(0.717783)	(0.978815)	(64.480838)
No PHC	-2.91260***	4.00963***	-489.57056***
	(0.712213)	(0.970655)	(63.890634)
Government dispensary	-1.06936***	0.37086	-152.26645***
	(0.333876)	(1.189800)	(26.529456)
No government dispensary	-0.08361	3.22785***	-80.91583***
	(0.323593)	(1.184699)	(25.296527)
Bank	-16.40237***	6.68718***	-1174.46895***
	(1.806310)	(0.605675)	(145.613432)
No Bank	-15.65380***	6.41231***	-1114.06556***
	(1.805348)	(0.600353)	(145.490050)
Chewing habits (Ref. never chewed) Pan: with or without tobacco	2.01942***	2.88106***	217.19651***
	(0.079241)	(0.117399)	(8.454126)
Gutka: with or without tobacco	0.54515***	1.63144***	36.41684***
	(0.119208)	(0.180495)	(11.945928)
Only tobacco	0.14359	0.95061***	16.63527
	(0.101478)	(0.155042)	(10.219673)
Ex-chewer	-0.35112*	0.45546*	-69.85915***
	(0.182048)	(0.254117)	(18.076457)
Smoking habits (Ref. never smoked):any smoker	1.84682***	2.00601***	227.81366***
	(0.081026)	(0.111386)	(8.637829)
Drinking habits (Ref. never drank): usual or occasional	-2.62551***	-4.97628***	-336.56179***
	(0.087990)	(0.118166)	(9.026228)
Ex-drinker	-0.34953**	-1.83912***	-61.17464***
	(0.143978)	(0.195480)	(14.745732)
Medical practitioner in village (Ref. no) : yes	-5.62353***	0.80419	-581.49896***
	(0.691441)	(0.754357)	(75.436169)
Medical practitioner per person in village	-3.65536	79.46397***	2076.47607***
	(5.021583)	(6.791024)	(589.646441)
Any health facility in village (Ref. no): yes	-0.32825***	0.78820***	0.12018
	(0.073791)	(0.115049)	(7.380229)
Distance of nearest bus station (km)	0.07980***	0.02511***	9.37021***
	(0.005053)	(0.003519)	(0.583149)
All weathered road to PHC (Ref. no): yes	-0.93980***	-2.59022***	-103.28793***
	(0.089788)	(0.134323)	(9.101561)
Schemes implemented in village (Ref. no): JSY	-1.90958***	1.91952***	-119.68445***
	(0.189858)	(0.224695)	(19.018952)
MDM (Ref. no): yes	-0.77344***	-0.05094	-48.04706***
	(0.108984)	(0.155640)	(10.851077)
ICDS (Ref. no): yes	0.18405*	0.93018***	26.28867**
	(0.105640)	(0.143055)	(10.281643)
Sanitation programme (Ref. no): yes	0.66594***	2.86772***	97.82710***
	(0.062685)	(0.096354)	(6.421199)
RG drinking water (Ref. no): yes	-0.46016***	-2.35562***	-64.96487***
	(0.071552)	(0.113969)	(6.844139)
Gram Rozgar Yojana (Ref. no): yes	0.80967***	1.95180***	65.54517***
	(0.066271)	(0.108128)	(6.598196)
Per capita real development expenditure	0.00001***	-0.00000	0.00274***
	(0.000003)	(0.000003)	(0.000395)
Percentage delay in MGNREGA	0.01367***	0.07808***	-2.60935***

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	(1)	(2)	(3)
payments (0-100)	(0.001411)	(0.002162)	(0.145334)
Total positive deviation in rainfall	-0.67917***	-0.24402***	-47.89374***
	(0.009862)	(0.013043)	(0.949077)
Absolute value of total negative deviation in rainfall	0.48197***	-0.85463***	48.62986***
	(0.012473)	(0.018416)	(1.318099)
PDS leakage (2011-2012)	-0.01315**	-0.85490***	-14.34337***
	(0.005733)	(0.006550)	(0.626854)
MGNREGA leakage (2011-2012)	-0.27996***	-0.25765***	-21.23344***
	(0.001784)	(0.003062)	(0.168016)
Per capita net state domestic product at factor cost and constant prices	-0.00031***	-0.00027***	-0.02583***
	(0.000005)	(0.000008)	(0.000530)
Growth in Per capita net state domestic product at factor cost and constant prices	1.09689***	1.66558***	113.98270***
	(0.058795)	(0.062169)	(6.608952)
Group (Ref. Children below 5) Children 5-11 years	-0.73364***	-1.62346***	-110.40976***
	(0.120957)	(0.180906)	(12.318083)
Children 12-14 years	-0.66593***	-1.62732***	-104.53450***
	(0.147937)	(0.222134)	(15.013765)
Non-pregnant women (15 years of age and above)	0.50150***	-0.88259***	22.40895
	(0.157440)	(0.237540)	(15.981254)
Pregnant women	-0.67938	-1.46962	-72.54700
	(1.424196)	(2.063727)	(145.678983)
Men (15 years of age and above)	0.64180***	-0.79742***	40.72718***
	(0.154906)	(0.234722)	(15.772084)
MGNREGA rationing rate (2011-2012)	-7.23778***	-10.68164***	219.07211***
	(0.320829)	(0.553631)	(32.975314)
Unit price difference for wheat (2011-2012)	0.74803***	0.22422***	94.14381***
	(0.015529)	(0.016513)	(1.628903)
MGNREGA rationing rate*Unit price difference for wheat(2011-2012)	-0.92878***	0.77800***	-111.28616***
	(0.030684)	(0.051059)	(3.182300)
Constant	67.83531***	164.76794***	4295.66196***
	(1.785723)	(2.746597)	(182.973630)
Observations	481715	481715	481715

Notes: Based on authors 'calculations

Appendix Table 8: LPM results

LPM: Different forms of Anaemia on MGNREGA Participation and PDS Access

	(1) Mild Anaemia or worse(=1) b/se	(2) Moderate Anaemia or worse(=1) b/se	(3) Severe Anaemia or worse(=1) b/se
MGNREGA participation rate	-0.00190***	-0.00404***	-0.00446***
(11-12)	(0.000513)	(0.000557)	(0.000468)
PDS participation rate (11-12)	-0.00702***	-0.00437***	-0.00388***
	(0.000767)	(0.000827)	(0.000531)
MGNREGA participation rate # PDS participation rate (11-12)	0.00005*** (0.000006)	0.00006*** (0.000007)	0.00005*** (0.000006)
IAP district (Ref. no)	0.07171***	0.03694***	0.02549***
	(0.008112)	(0.008867)	(0.005383)
MGNREGA implemented in phase-1	0.01175***	0.01228***	0.00020
(Ref. no)	(0.003053)	(0.003309)	(0.001875)
MGNREGA implemented in phase-2	0.04972***	0.05973***	0.02972***
(Ref. no)	(0.003203)	(0.003512)	(0.002354)
Mild anaemia % in children DLHS 2	-0.00023**	-0.00029***	-0.00031***
	(0.000099)	(0.000106)	(0.000072)
Moderate anaemia % in children	0.00006	0.00071***	0.00020*
DLHS 2	(0.000151)	(0.000163)	(0.000111)
Severe anaemia % in children DLHS	0.00250***	0.00214***	-0.00018
2	(0.000318)	(0.000351)	(0.000248)

	(1)	(2)	(3)
Gender (Ref. Male) : Female	0.01029***	0.01431***	0.00641***
	(0.002782)	(0.002999)	(0.002159)
Other	0.14392***	0.29831***	0.14298
	(0.016072)	(0.020537)	(0.258700)
Social Group (Ref: others): Scheduled Castes	-0.00534*	-0.00283	-0.00489**
	(0.003096)	(0.003307)	(0.002124)
Scheduled Tribes	0.01276***	0.02311***	0.01568***
	(0.003447)	(0.003772)	(0.002691)
Other Backward Classes	0.00485*	0.00757***	0.00217
	(0.002737)	(0.002912)	(0.001954)
Marital status (Ref. no response): Married	-0.05180***	-0.05257***	-0.02977***
	(0.004860)	(0.005089)	(0.003510)
Unmarried	-0.05065***	-0.05191***	-0.02926***
	(0.004307)	(0.004474)	(0.003124)
Pregnancy status (Ref. not pregnant): Pregnant	-0.05864	-0.11769*	-0.06068*
	(0.064439)	(0.065865)	(0.034742)
Age in years	0.00096***	0.00095***	0.00045***
	(0.000062)	(0.000068)	(0.000046)
Source of water (Ref. unimproved): Improved source	-0.02644***	-0.02140***	-0.02665***
	(0.004226)	(0.004593)	(0.003157)
Other	-0.04490***	-0.05872***	-0.01736*
	(0.015288)	(0.015984)	(0.009742)
Nature of toilet (Ref. open): Improved	-0.01872***	-0.01328***	-0.00032
	(0.002275)	(0.002464)	(0.001671)
Unimproved	-0.02435***	-0.01845***	0.00385
	(0.004590)	(0.005063)	(0.003545)
Other	0.00690	0.00492	0.00803
	(0.012880)	(0.014376)	(0.010421)
House type (Ref. others): Pakka	-0.02000***	-0.01593***	-0.00973***
	(0.002459)	(0.002603)	(0.001737)
Cooking fuel (Ref. air polluting sources): Non indoor polluting sources	0.00874***	0.00219	-0.00557***
	(0.002321)	(0.002456)	(0.001650)
Female share in Household	0.00038***	0.00027***	0.00007*
	(0.000052)	(0.000056)	(0.000037)
Land ownership (Ref. No) : Yes	0.00402	-0.00420	0.00647***
	(0.002646)	(0.002835)	(0.001892)
Wealth Index (0-100)	0.00113***	0.00114***	0.00063***
	(0.000071)	(0.000075)	(0.000052)
Chronic Illness (Ref. None): all other	0.00209	0.00185	-0.00775***

	(1)	(2)	(3)
chronic illnesses	(0.002533)	(0.002822)	(0.001901)
Inflammatory anaemia: gastrointestinal	0.01254*	0.01531*	-0.00315
	(0.007555)	(0.008566)	(0.005860)
Education level (Ref. illiterate):	0.01348	0.03678***	0.02363***
Literate Without formal education	(0.008393)	(0.009839)	(0.006868)
Literate formal: up to class X	0.01741**	0.03189***	0.02730***
	(0.007078)	(0.008375)	(0.005953)
Literate formal: higher secondary and	-0.00202	0.02046**	0.02485***
above	(0.007416)	(0.008702)	(0.006133)
Education level of HH head (Ref. illiterate): literate without formal	0.04308**	0.00102	0.01013
education	(0.017543)	(0.020574)	(0.015032)
Literate formal: up to class X	0.02293	-0.00603	0.00367
	(0.014313)	(0.016492)	(0.012266)
Literate formal: higher secondary and	0.02113	-0.01012	0.00275
above	(0.014384)	(0.016563)	(0.012309)
Occupation(Ref. no): Administration,	-0.00946	-0.00859	-0.00653
executive or manager	(0.009590)	(0.009579)	(0.005704)
Clerk	-0.03824***	-0.03046***	-0.00173
	(0.006548)	(0.006579)	(0.004067)
Service Staff	-0.00629	0.00064	-0.00169
	(0.004911)	(0.005107)	(0.003232)
Cultivator	-0.00851**	-0.01869***	-0.01148***
	(0.004171)	(0.004448)	(0.002928)
Agricultural labor	-0.00668	-0.01482***	-0.01260***
	(0.004271)	(0.004564)	(0.003070)
Forest, fishing and mining	-0.00093	0.00525	-0.00610
	(0.007731)	(0.008294)	(0.005090)
Skilled labor	-0.00903**	-0.01184***	-0.00299
	(0.004040)	(0.004269)	(0.002749)
Occupation of head (Ref.	-0.01215	-0.00892	-0.00028
Administration, executive or manager	(0.008409)	(0.008803)	(0.005576)
occup of head:clerical staff=0	0.00000	0.00000	0.00000
	(.)	(.)	(.)
Clerk	0.00313	-0.00343	-0.00082
	(0.005903)	(0.006135)	(0.004173)
occup of head:service staff=0	0.00000	0.00000	0.00000
	(.)	(.)	(.)
Service Staff	-0.00389	-0.00902*	-0.00787**

	(1)	(2)	(3)
	(0.004469)	(0.004727)	(0.003140)
Cultivator	0.00757*	0.00510	-0.00471
	(0.004020)	(0.004287)	(0.002891)
Agricultural labor	0.02347***	0.01332***	-0.00020
	(0.004202)	(0.004460)	(0.002987)
Forest, fishing and mining mining	0.01377**	0.01604**	0.01590***
	(0.006447)	(0.007006)	(0.004776)
Skilled labor	0.00303	-0.00290	-0.00791***
	(0.003754)	(0.003985)	(0.002671)
Village availability (Ref. no response):	-0.09276	-0.08242	-0.14082***
SHG	(0.066460)	(0.083814)	(0.036330)
No SHG	-0.10845	-0.09726	-0.14659***
	(0.066594)	(0.083936)	(0.036422)
ICDS	0.19469	0.35990**	-0.13613
	(0.143966)	(0.151192)	(0.132088)
No ICDS	0.22687	0.39085***	-0.08757
	(0.144147)	(0.151396)	(0.132313)
PHC	0.02507	0.00530	0.10106***
	(0.028857)	(0.034936)	(0.027777)
No PHC	0.03617	0.01652	0.10390***
	(0.028682)	(0.034765)	(0.027604)
Government dispensary	-0.00653	-0.03650*	-0.03389*
	(0.020507)	(0.020669)	(0.018731)
No government dispensary	0.00942	-0.02463	-0.02457
	(0.020598)	(0.020779)	(0.018672)
Bank	-0.05256	-0.08849**	0.09052***
	(0.032510)	(0.044678)	(0.015474)
No bank	-0.05166	-0.08854**	0.09099***
	(0.032391)	(0.044570)	(0.015373)
Chewing habits (Ref. never chewed)	0.00000	0.00000	0.00000
	(.)	(.)	(.)
Chewing habits (Ref. never chewed)	0.02047***	0.01783***	0.02107***
Pan: with or without tobacco	(0.003220)	(0.003542)	(0.002378)
Gutka: with or without tobacco	-0.01575***	-0.02388***	-0.00738**
	(0.004914)	(0.005343)	(0.003424)
Only tobacco	0.00379	-0.00622	0.00116
	(0.003766)	(0.004260)	(0.002867)
Ex-chewer	0.02085***	0.01095	-0.00295
	(0.006178)	(0.006881)	(0.004403)

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	(1)	(2)	(3)
Smoking habits (Ref. never smoked): any smoker	0.00995***	0.01429***	0.01027***
	(0.003224)	(0.003477)	(0.002232)
Drinking habits (Ref. never drank): usual or occasional	-0.05016***	-0.04392***	-0.03432***
	(0.004437)	(0.004751)	(0.003059)
Ex-drinker	-0.01416***	-0.01371**	-0.01230***
	(0.005432)	(0.005961)	(0.003749)
Medical practitioner in village (Ref. no): yes	0.04560***	0.01885	0.00357
	(0.013260)	(0.014082)	(0.009416)
Medical practitioner per person in village	0.18059	0.24761	0.48041***
	(0.153321)	(0.164305)	(0.108672)
Any health facility in village (Ref. no): yes	-0.00608***	-0.01354***	-0.00173
	(0.002309)	(0.002504)	(0.001647)
Distance of nearest bus station (km)	-0.00040***	-0.00030***	0.00019***
	(0.000064)	(0.000064)	(0.000046)
All weathered road to PHC (Ref. no): yes	-0.02758***	-0.02890***	-0.01455***
	(0.003058)	(0.003269)	(0.002177)
Schemes implemented in village (Ref. no): JSY	0.01070**	0.00673	-0.00885***
	(0.004389)	(0.004613)	(0.002821)
MDM (Ref. no): yes	-0.01543***	-0.00787**	0.00431**
	(0.003015)	(0.003177)	(0.001903)
ICDS (Ref. no): yes	0.00604**	0.00374	0.00670***
	(0.003024)	(0.003167)	(0.001901)
Sanitation programme (Ref. no): yes	0.02164***	0.01154***	0.01077***
	(0.002903)	(0.003106)	(0.002125)
RG drinking water (Ref. no): yes	-0.00316	0.01044***	0.00008
	(0.002819)	(0.003023)	(0.002046)
Gram Rozgar Yojana (Ref. no): yes	0.01917***	0.02303***	0.01898***
	(0.002488)	(0.002668)	(0.001758)
Per capita real development expenditure	0.00000***	0.00000***	0.00000***
	(0.000000)	(0.000000)	(0.000000)
Percentage delay in MGNREGA Payments (0-100)	0.00073***	0.00047***	0.00052***
	(0.000079)	(0.000086)	(0.000062)
Total positive deviation in rainfall mean	-0.00625***	-0.00724***	-0.00355***
	(0.000293)	(0.000328)	(0.000243)
Absolute value of total negative deviation in rainfall	-0.01822***	-0.01538***	-0.01078***
	(0.000883)	(0.000948)	(0.000576)
PDS leakage (2011-2012)	-0.00070	0.00212***	-0.00119***
	(0.000671)	(0.000730)	(0.000436)
MGNREGA leakage (2011-2012)	-0.00185***	-0.00128***	-0.00104***

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	(1)	(2)	(3)
	(0.000155)	(0.000167)	(0.000137)
Per capita net state domestic product at	-0.00000***	-0.00000***	0.00000*
Factor cost and constant prices	(0.000000)	(0.000000)	(0.000000)
Growth in Per capita net state domestic product at factor cost and constant	0.01848***	0.01210***	0.00436***
prices	(0.001578)	(0.001706)	(0.001194)
Group (Ref. Children below 5)	-0.05015***	0.03954***	0.00175
Children 5-11 years	(0.005489)	(0.005909)	(0.004177)
Children 12-14 years	0.01701**	0.01821**	0.00005
	(0.006966)	(0.007463)	(0.005183)
Non-pregnant women (15 years of age	0.02897***	0.04965***	0.02431***
And above)	(0.007144)	(0.007646)	(0.005353)
Pregnant women	-0.02486	0.03344	0.02990
	(0.064784)	(0.066252)	(0.035122)
Men (15 years of age and above)	0.01344*	-0.10112***	-0.01190**
	(0.007110)	(0.007580)	(0.005223)
Constant	2.10493***	1.43633***	1.10095***
	(0.196205)	(0.210867)	(0.161967)
Observations	481719	481719	459757

Appendix Table 9: Full IV results

	(1) Haemoglobin differential from benchmark (%) b/se	(2) Ln of Haemoglobin level b/se
MGNREGA participation rate (11-12)	0.21161***	0.00291***
	(0.018213)	(0.000228)
PDS participation rate (11-12)	0.34703***	0.00309***
	(0.026950)	(0.000341)
MGNREGA participation rate # PDS	-0.00323***	-0.00004***
participation rate (11-12)	(0.000231)	(0.000003)
IAP district (Ref. no)	-2.75371***	-0.02116***
	(0.279479)	(0.003473)
MGNREGA implemented in phase-1	-0.61865***	-0.00674***
(Ref. no)	(0.106848)	(0.001337)
MGNREGA implemented in phase-2	-2.13695***	-0.02542***
(Ref. no)	(0.115483)	(0.001431)
Mild anaemia % in children DLHS 2	0.01608***	0.00024***
	(0.003422)	(0.000042)
Moderate anaemia % in children DLHS 2	-0.04186***	-0.00061***
	(0.005304)	(0.000067)
Severe anaemia % in children DLHS 2	-0.09831***	-0.00078***
	(0.010903)	(0.000135)
Proportion of poor in district	-1.12248***	-0.00808**
	(0.316765)	(0.003906)
Gender (Ref. Male) : Female	-0.56890***	-0.00688***
	(0.135076)	(0.001640)
Other	-9.13531**	-0.09669*
	(4.157327)	(0.054065)
Social Group (Ref: others): Scheduled Castes	0.05431	0.00038
	(0.107607)	(0.001303)
Scheduled Tribes	-1.42680***	-0.01906***
	(0.123436)	(0.001523)
Other Backward Classes	-0.34966***	-0.00466***
	(0.097159)	(0.001164)
Marital status (Ref. no response): Married	3.08204***	0.03563***
	(0.218276)	(0.002603)
Unmarried	2.62105***	0.03092***
	(0.191351)	(0.002273)
Pregnancy status (Ref. not pregnant): Pregnant	6.23257*	-0.00758
	(3.639893)	(0.038150)
Age in years	-0.05279***	-0.00064***
	(0.002827)	(0.000035)
Source of water (Ref. unimproved): improved	1.60925***	0.01712***
source	(0.147184)	(0.001821)
Other	2.58019***	0.02912***
	(0.504185)	(0.006054)
Nature of toilet (Ref. open): Improved	0.59467***	0.00395***
	(0.079623)	(0.000981)
Unimproved	1.17283***	0.00743***
	(0.167260)	(0.002010)
Other	-0.85711*	-0.01256**
	(0.437452)	(0.005581)
House type (Ref. others): Pakka	0.82429***	0.00825***

	(1)	(2)
	(0.085398)	(0.001041)
Cooking fuel (Ref. air polluting sources): Non indoor polluting sources	-0.43533***	-0.00195**
	(0.081971)	(0.000987)
Female share in Household	-0.01596***	-0.00016***
	(0.001969)	(0.000024)
Land ownership (Ref. No) : Yes	-0.29055***	-0.00133
	(0.094217)	(0.001161)
Wealth Index (0-100)	-0.05904***	-0.00065***
	(0.002503)	(0.000031)
Chronic Illness (Ref. None): all other chronic illnesses	-0.09373	0.00020
	(0.113795)	(0.001404)
Inflammatory anaemia: gastrointestinal	-0.78455**	-0.00814*
	(0.350708)	(0.004416)
Education level (Ref. illiterate): Literate without formal education	-1.39425***	-0.01798***
	(0.379487)	(0.004803)
Literate formal: up to class X	-1.51108***	-0.01942***
	(0.325570)	(0.004160)
Literate formal: higher secondary and above	-0.15212	-0.00662
	(0.342824)	(0.004345)
Education level of HH head (Ref. illiterate): literate without formal education	-0.76478	-0.00967
	(0.746273)	(0.009527)
Literate formal: up to class X	-0.13223	-0.00238
	(0.614048)	(0.007894)
Literate formal: higher secondary and above	0.05434	-0.00011
	(0.616298)	(0.007919)
Occupation(Ref. no): Administration, executive or manager	0.37472	0.00575
	(0.479449)	(0.005437)
Clerk	1.89587***	0.02084***
	(0.323001)	(0.003642)
Service Staff	-0.08137	0.00044
	(0.230482)	(0.002766)
Cultivator	0.56201***	0.00819***
	(0.195966)	(0.002368)
Agricultural labor	0.50270**	0.00846***
	(0.199490)	(0.002410)
Forest, fishing and mining	-0.03139	0.00069
	(0.360619)	(0.004380)
Skilled labor	0.21822	0.00431*
	(0.187671)	(0.002253)
Occupation of head (Ref. no): Administration, executive or manager	1.52659***	0.01279***
	(0.343345)	(0.003765)
Clerk	0.42100*	0.00459*
	(0.221856)	(0.002523)
Service Staff	0.00297	0.00416**
	(0.161553)	(0.001915)
Cultivator	-0.68469***	-0.00354**
	(0.145580)	(0.001750)
Agricultural labor	-1.26859***	-0.00854***
	(0.152419)	(0.001827)
Forest, fishing and mining	-1.18924***	-0.01468***
	(0.236348)	(0.002876)
Skilled labor	-0.55540***	-0.00172
	(0.136830)	(0.001629)
Village availability (Ref. no response): SHG	6.02364**	0.04434
	(2.927140)	(0.038804)

	(1)	(2)
No SHG	6.74244**	0.05034
	(2.930517)	(0.038838)
ICDS	-7.94254	-0.11221
	(6.520133)	(0.094085)
No ICDS	-11.06391*	-0.15768*
	(6.528081)	(0.094206)
PHC	2.62090*	0.05006**
	(1.400729)	(0.019974)
No PHC	1.60914	0.03970**
	(1.395355)	(0.019909)
Government dispensary	-0.73496	-0.00173
	(0.895189)	(0.010086)
No government dispensary	-1.40139	-0.00886
	(0.900862)	(0.010152)
Bank	1.03740	0.03533
	(1.523434)	(0.025936)
No bank	0.74239	0.03173
	(1.520164)	(0.025907)
Chewing habits (Ref. never chewed) Pan: with or without tobacco	-1.28054***	-0.01516***
	(0.131762)	(0.001614)
Gutka: with or without tobacco	1.13123***	0.01141***
	(0.223317)	(0.002769)
Only tobacco	-0.11646	-0.00155
	(0.174054)	(0.002182)
Ex-chewer	-0.84903***	-0.00779**
	(0.277203)	(0.003470)
Smoking habits (Ref. never smoked):any smoker	-0.67665***	-0.00780***
	(0.140604)	(0.001717)
Drinking habits (Ref. never drank): usual or occasional	2.81175***	0.03085***
	(0.173987)	(0.002146)
Ex-drinker	0.80324***	0.00845***
	(0.246910)	(0.003067)
Medical practitioner in village (Ref. no) : yes	-1.64162***	-0.01580***
	(0.452952)	(0.005537)
Medical practitioner per person in village	-24.84476***	-0.26428***
	(5.806872)	(0.069801)
Any health facility in village (Ref. no): yes	0.33633***	0.00536***
	(0.079799)	(0.000991)
Distance of nearest bus station (km)	0.00281	-0.00005**
	(0.002058)	(0.000026)
All weathered road to PHC (Ref. no): yes	1.59866***	0.01755***
	(0.107593)	(0.001332)
Schemes implemented in village (Ref. no): JSY	-0.02455	0.00296*
	(0.145578)	(0.001782)
MDM (Ref. no): yes	0.50338***	0.00357***
	(0.098743)	(0.001200)
ICDS (Ref. no): yes	-0.35846***	-0.00315**
	(0.102161)	(0.001250)
Sanitation programme (Ref. no): yes	-1.36967***	-0.01159***
	(0.102326)	(0.001254)
RG drinking water (Ref. no): yes	0.33508***	-0.00078
	(0.100395)	(0.001225)
Gram Rozgar Yojana (Ref. no): yes	-0.96042***	-0.01237***
	(0.086646)	(0.001055)

	(1)	(2)
Per capita real development expenditure	-0.00008***	-0.00000***
	(0.000002)	(0.000000)
Percentage delay in MGNREGA payments (0-	-0.03689***	-0.00037***
100)	(0.002874)	(0.000036)
Total positive deviation in rainfall	0.38526***	0.00468***
	(0.010724)	(0.000135)
Absolute value of total negative deviation in	0.85557***	0.00979***
rainfall	(0.030665)	(0.000381)
PDS leakage (2011-2012)	0.09111***	0.00013
	(0.023587)	(0.000300)
MGNREGA leakage (2011-2012)	0.07085***	0.00075***
	(0.005426)	(0.000067)
Per capita net state domestic product at factor cost and constant prices	0.00006***	0.00000**
	(0.000008)	(0.000000)
Growth in Per capita net state domestic product at	-0.54344***	-0.00518***
factor cost and constant prices	(0.054677)	(0.000680)
Group (Ref. Children below 5) Children 5-11 years	3.74116***	0.09397***
	(0.260850)	(0.003182)
Children 12-14 years	0.74785**	0.10238***
	(0.326885)	(0.003956)
Non-pregnant women (15 years of age and above)	-0.56622*	0.08242***
	(0.334936)	(0.004068)
Pregnant women	-1.57699	0.05998
	(3.655471)	(0.038348)
Men (15 years of age and above)	-0.56637*	0.16115***
	(0.332195)	(0.004020)
Constant	-85.06216***	1.48787***
	(8.091990)	(0.110641)
Observations	481723	481723

Appendix Table 10: Full IV probit results

Second Stage Results of IV probit regressions: Marginal effects of MNREGS Participation and PDS Access on probability of anaemia of different forms

	(1) Mild Anema or worse(=1) b/se	(2) Moderate Anaemia or worse (=1) b/se	(3) Severe anaemia(=1) b/se
MGNREGA participation	-0.00703***	-0.01088***	-0.01507***
rate (11-12)	(0.001564)	(0.001469)	(0.001817)
PDS participation rate (11-12)	-0.02029***	-0.01139***	-0.00483*
	(0.002203)	(0.002133)	(0.002543)
MGNREGA participation rate	0.00016***	0.00015***	0.00012***
# PDS participation rate (11-12)	(0.000019)	(0.000018)	(0.000023)
IAP district (Ref. no)	0.19700***	0.09518***	0.00859
	(0.023823)	(0.022966)	(0.027754)
MGNREGA implemented in phase-1	0.03345***	0.03233***	0.01532
(Ref. no)	(0.009131)	(0.008641)	(0.010797)
MGNREGA implemented in	0.14419***	0.15546***	0.09398***
phase-2 (Ref. no)	(0.009194)	(0.008879)	(0.011014)
Mild anaemia % in children DLHS 2	-0.00076**	-0.00075***	-0.00115***
	(0.000301)	(0.000282)	(0.000359)
Moderate anaemia % in children	0.00021	0.00191***	0.00420***
DLHS 2	(0.000464)	(0.000437)	(0.000547)
Severe anaemia % in children DLHS	0.00684***	0.00550***	-0.00211*
2	(0.000989)	(0.000916)	(0.001222)
Proportion of poor in district	0.12200***	0.09703***	0.01572
	(0.028018)	(0.026060)	(0.031954)
Gender (Ref. Male) : Female	0.03018***	0.03780***	0.03218***
	(0.008271)	(0.007949)	(0.010024)
Other	0.00000	0.00000	0.16651
	(.)	(.)	(0.652842)
Social Group (Ref: others):	-0.01704*	-0.00760	-0.00690
Scheduled Castes	(0.009230)	(0.008665)	(0.010810)
Scheduled Tribes	0.03932***	0.06109***	0.08170***
	(0.010715)	(0.010036)	(0.012509)
Other Backward Classes	0.01377*	0.01962**	0.01455
	(0.008135)	(0.007642)	(0.009635)
Marital status (Ref. no response):	-0.14717***	-0.14063***	-0.14808***
Married	(0.013968)	(0.013465)	(0.017284)
Unmarried	-0.14302***	-0.13840***	-0.13500***
	(0.012068)	(0.011794)	(0.014990)
Pregnancy status (Ref. not pregnant):	-0.16933	-0.30166*	-0.42476
Pregnant	(0.176469)	(0.172127)	(0.298599)
Age in years	0.00288***	0.00250***	0.00207***
	(0.000185)	(0.000177)	(0.000231)
Source of water (Ref. unimproved):	-0.07743***	-0.05608***	-0.07302***
Improved source	(0.012563)	(0.011953)	(0.014398)
Other	-0.14030***	-0.15582***	-0.04819
	(0.044401)	(0.041877)	(0.051365)
Nature of toilet (Ref. open):	-0.05787***	-0.03532***	0.01902**
Improved	(0.006895)	(0.006471)	(0.008137)
Unimproved	-0.07767***	-0.04944***	0.03112*

	(1)	(2)	(3)
	(0.013982)	(0.013270)	(0.017535)
Other	0.02448	0.01216	0.07300
	(0.043312)	(0.037950)	(0.050832)
House type (Ref. others): Pakka	-0.05788***	-0.04124***	-0.03193***
	(0.007072)	(0.006747)	(0.008387)
Cooking fuel (Ref. air polluting sources): Non indoor polluting sources	0.02852***	0.00596	-0.01691**
	(0.006753)	(0.006437)	(0.008303)
Female share in Household	0.00115***	0.00072***	0.00034*
	(0.000157)	(0.000148)	(0.000189)
Land ownership (Ref. No) : Yes	0.00989	-0.01126	-0.01318
	(0.008030)	(0.007520)	(0.009178)
Wealth Index (0-100)	0.00343***	0.00297***	0.00192***
	(0.000198)	(0.000191)	(0.000237)
Chronic Illness (Ref. None): all other chronic illnesses	0.01110	0.00490	-0.02318**
	(0.008010)	(0.007431)	(0.009498)
Inflammatory anaemia: gastrointestinal	0.04702*	0.04076*	-0.00945
	(0.024985)	(0.022617)	(0.028615)
Education level (Ref. illiterate): Literate Without formal education	0.03899	0.09732***	0.10102***
	(0.027435)	(0.025754)	(0.031907)
Literate formal: up to class X	0.04934**	0.08409***	0.10905***
	(0.023050)	(0.021816)	(0.026675)
Literate formal: higher secondary and above	-0.00150	0.05478**	0.08767***
	(0.023919)	(0.022679)	(0.028001)
Education level of HH head (Ref. illiterate): literate without formal education	0.14269**	0.00267	0.04873
	(0.059129)	(0.054610)	(0.067263)
Literate formal: up to class X	0.06483	-0.01555	0.01113
	(0.046973)	(0.043645)	(0.053468)
Literate formal: higher secondary and above	0.05927	-0.02644	0.00135
	(0.047152)	(0.043828)	(0.053731)
Occupation(Ref. no): Administration, executive or manager	-0.02116	-0.02840	-0.06544*
	(0.025959)	(0.026150)	(0.038448)
Clerk	-0.10435***	-0.08425***	-0.02347
	(0.018019)	(0.017812)	(0.025292)
Service Staff	-0.01765	0.00247	-0.02166
	(0.013928)	(0.013570)	(0.018802)
Cultivator	-0.02711**	-0.04840***	-0.05385***
	(0.012300)	(0.011799)	(0.015913)
Agricultural labor	-0.02185*	-0.03991***	-0.07412***
	(0.012763)	(0.012142)	(0.016268)
Forest, fishing and mining	-0.00302	0.01343	-0.02192
	(0.022445)	(0.021947)	(0.029961)
Skilled labor	-0.02762**	-0.03036***	-0.04051***
	(0.011785)	(0.011362)	(0.015501)
Occupation of head (Ref. no): Administration, executive or manager	-0.02947	-0.02238	0.00876
	(0.023398)	(0.023204)	(0.029929)
Clerk	0.00990	-0.00898	-0.02396
	(0.016859)	(0.016130)	(0.021552)
Service Staff	-0.01141	-0.02341*	-0.04873***
	(0.012835)	(0.012371)	(0.016212)
Cultivator	0.02160*	0.01344	-0.01427
	(0.011876)	(0.011290)	(0.014492)
Agricultural labor	0.07009***	0.03553***	-0.00959
	(0.012428)	(0.011742)	(0.014853)

	(1)	(2)	(3)
Forest, fishing and mining	0.04046**	0.04230**	0.07986***
	(0.019146)	(0.018451)	(0.023241)
Skilled labor	0.00772	-0.00752	-0.02515*
	(0.010979)	(0.010472)	(0.013568)
Village availability (Ref. no response): SHG	-0.17446	-0.19677	-0.57992**
	(0.224773)	(0.220572)	(0.240859)
No SHG	-0.22250	-0.23508	-0.60142**
	(0.225070)	(0.220858)	(0.241243)
ICDS	0.09229	0.59482	1.14076*
	(0.501081)	(0.457784)	(0.595417)
No ICDS	0.19537	0.67965	1.31792**
	(0.501610)	(0.458264)	(0.596204)
PHC	0.11386	0.02391	-0.34977***
	(0.104803)	(0.093848)	(0.114735)
No PHC	0.14353	0.05297	-0.31800***
	(0.104389)	(0.093392)	(0.114069)
Government dispensary	-0.02966	-0.10218*	-0.06865
	(0.071345)	(0.057625)	(0.057124)
No government dispensary	0.01729	-0.07128	-0.05922
	(0.071642)	(0.057934)	(0.057404)
Bank	-0.23738*	-0.24865*	0.19221
	(0.140422)	(0.128788)	(0.147847)
No bank	-0.23389*	-0.24891*	0.21303
	(0.140149)	(0.128522)	(0.147478)
Chewing habits (Ref. never chewed) Pan: with or without tobacco	0.05965***	0.04631***	0.07280***
	(0.009725)	(0.009196)	(0.011727)
Gutka: with or without tobacco	-0.05233***	-0.06056***	-0.02567
	(0.014844)	(0.014068)	(0.018502)
Only tobacco	0.00943	-0.01603	0.01024
	(0.012119)	(0.011210)	(0.014410)
Ex-chewer	0.06840***	0.02887	-0.02953
	(0.019569)	(0.018193)	(0.024218)
Smoking habits (Ref. never smoked): any smoker	0.02818***	0.03564***	0.02185*
	(0.009663)	(0.009140)	(0.012442)
Drinking habits (Ref. never drank): usual or occasional	-0.14283***	-0.11399***	-0.11551***
	(0.012522)	(0.012197)	(0.015737)
Ex-drinker	-0.04042**	-0.03548**	-0.01906
	(0.016426)	(0.015611)	(0.020776)
Medical practitioner in village (Ref. no) : yes	0.13710***	0.05354	-0.00313
	(0.038580)	(0.038192)	(0.048843)
medical practitioner per person in village	0.35732	0.61697	1.60102***
	(0.439222)	(0.428281)	(0.461378)
Any health facility in village (Ref. no): yes	-0.02139***	-0.03583***	-0.02609***
	(0.007123)	(0.006649)	(0.008199)
Distance of nearest bus station (km)	-0.00123***	-0.00082***	0.00109***
	(0.000186)	(0.000175)	(0.000214)
All weathered road to PHC (Ref. no): yes	-0.08237***	-0.07658***	-0.04929***
	(0.008893)	(0.008416)	(0.010528)
Schemes implemented in village (Ref. no): JSY	0.03378***	0.01679	-0.07381***
	(0.012753)	(0.012128)	(0.015832)
MDM (Ref. no): yes	-0.04305***	-0.02068**	0.03542***
	(0.008807)	(0.008313)	(0.010986)
ICDS (Ref. no): yes	0.01837**	0.00971	0.01638
	(0.008591)	(0.008271)	(0.010931)
Sanitation programme (Ref. no): yes	0.06198***	0.02971***	0.00136

	(1)	(2)	(3)
	(0.008391)	(0.008065)	(0.009936)
RG drinking water (Ref. no): yes	-0.00668	0.02780***	0.02406**
	(0.008484)	(0.008031)	(0.009797)
Gram Rozgar Yojana (Ref. no): yes	0.05746***	0.06028***	0.07206***
	(0.007324)	(0.006897)	(0.008391)
Per capita real development expenditure	0.00000***	0.00000***	0.00001***
	(0.000000)	(0.000000)	(0.000000)
Percentage delay in MGNREGA Payments (0-100)	0.00232***	0.00124***	0.00132***
	(0.000229)	(0.000222)	(0.000269)
Total positive deviation in rainfall mean	-0.02085***	-0.01928***	-0.02091***
	(0.000943)	(0.000867)	(0.001115)
Absolute value of total negative deviation in rainfall	-0.05358***	-0.04016***	-0.03881***
	(0.002268)	(0.002332)	(0.002884)
PDS leakage (2011-2012)	-0.00051	0.00569***	0.00441*
	(0.002100)	(0.001960)	(0.002288)
MGNREGA leakage (2011-2012)	-0.00611***	-0.00337***	-0.00146***
	(0.000433)	(0.000427)	(0.000514)
Per capita net state domestic product at Factor cost and constant prices	-0.00001***	-0.00000***	0.00000***
	(0.000001)	(0.000001)	(0.000001)
Growth in Per capita net state domestic product at factor cost and constant prices	0.05829***	0.03217***	-0.00415
	(0.004729)	(0.004473)	(0.005071)
Group (Ref. Children below 5) Children 5-11 years	-0.14499***	0.10762***	0.02607
	(0.016229)	(0.015799)	(0.020168)
Children 12-14 years	0.04814**	0.05165***	0.01310
	(0.020635)	(0.019732)	(0.025470)
Non-pregnant women (15 years of age and above)	0.08363***	0.13300***	0.14143***
	(0.021208)	(0.020301)	(0.026234)
Pregnant women	-0.07199	0.08915	0.26033
	(0.177500)	(0.173166)	(0.299942)
Men (15 years of age and above)	0.03487*	-0.25525***	-0.06591**
	(0.020884)	(0.019940)	(0.025948)
Constant	5.13965***	2.78626***	0.61732
	(0.623910)	(0.590905)	(0.740737)
Observations	481715	481715	481719

Appendix Table 11: Full Restricted Cubic Spline results

Full restricted Cubic Splines: Non linear impact of MGNREGA and PDS on anaemia differential

	(1) PDS b/se	(2) MGNREGA b/se
PDS access rate: 12.27% to 34.26%	0.19608***	
	(0.027695)	
34.26% to 64.82%	-0.61784***	
	(0.049339)	
64.82% to 86.39%	1.34994***	
	(0.127558)	
86.39% to 96.38%	-1.40640***	
	(0.239632)	
MGNREGA participation rate: 0 to 4.68%		0.82822***
		(0.036990)
4.68% to 17.18 %		-34.95668***
		(1.976890)
17.18 % to 34.37%		51.10017***
		(2.946174)
34.37% to 79.68%		-18.74550***
		(1.172648)
MGNREGA participation rate	0.11852***	
	(0.008013)	
PDS access rate		0.05575**
		(0.027067)
IAP district (Ref. no)	-0.11067	-0.68946**
	(0.312991)	(0.325422)
MGNREGA implemented in phase-1 (Ref. no)	-0.61766***	0.02536
	(0.155119)	(0.161835)
MGNREGA implemented in phase-1 (Ref. no)	-1.79910***	-1.39161***
	(0.174207)	(0.192473)
Mild anaemia % in children DLHS 2	0.03723***	0.04679***
	(0.003384)	(0.003561)
Moderate anaemia % in children DLHS 2	-0.10772***	-0.09727***
	(0.003322)	(0.003522)
Severe anaemia % in children DLHS 2	-0.03317***	0.03164**
	(0.010562)	(0.012824)
Proportion of poor in district	-2.15378***	-4.68768***
	(0.323912)	(0.329232)
Gender (Ref. Male) : Female	-0.60993***	-0.60292***
	(0.128276)	(0.125817)
Other	-10.50512**	-11.46033**
	(4.685015)	(5.429011)
Social Group (Ref: others): Scheduled Caste	-0.44454***	-0.39363***
	(0.118469)	(0.119246)
Social Group (Ref: others): Scheduled Tribe	-2.13445***	-1.25304***
	(0.130441)	(0.140309)
Other Backward Classes	-0.45351***	-0.41527***
	(0.128610)	(0.140704)
Marital status (Ref. no response): Married	3.27582***	3.08958***
	(0.218009)	(0.210036)
Unmarried	2.52136***	2.42294***
	(0.197212)	(0.197362)
Pregnancy status (Ref. not pregnant): Pregnant	6.27923*	6.22169*
	(3.680527)	(3.653611)
Age in years	-0.04781***	-0.04190***
	(0.004256)	(0.004107)

	(1)	(2)
Source of water (Ref. unimproved): improved source	0.96658***	0.89949***
	(0.181053)	(0.194905)
Other	2.89582***	2.66860***
	(0.502246)	(0.485944)
Nature of toilet (Ref. open): Improved	0.41531***	0.43591***
	(0.103192)	(0.098870)
Unimproved	0.66490***	0.83514***
	(0.171345)	(0.171931)
Other	-1.22622***	-0.63990
	(0.420109)	(0.435027)
House type (Ref. others): Pakka	0.55695***	0.28843***
	(0.087772)	(0.088622)
Cooking fuel (Ref. air polluting sources): Non indoor polluting sources	-0.25450***	-0.42483***
	(0.082733)	(0.085726)
Female share in Household	-0.01263***	-0.01349***
	(0.002110)	(0.002025)
Land ownership (Ref. No) : Yes	0.40080***	0.42885***
	(0.085578)	(0.075913)
Wealth Index (0-100)	-0.04027***	-0.03813***
	(0.002479)	(0.002414)
Chronic Illness (Ref. None): all other chronic illnesses	-0.32180***	-0.51905***
	(0.110396)	(0.125214)
Inflammatory anaemia: gastrointestinal	-0.81031***	-1.37741***
	(0.313000)	(0.345493)
Education level (Ref. illiterate): Literate without formal education	-2.00394***	-1.12817***
	(0.377440)	(0.359055)
Literate formal: up to class X	-1.68865***	-0.79591**
	(0.334716)	(0.309826)
Literate formal: higher secondary and above	-0.08268	0.73850**
	(0.360987)	(0.337099)
Education level of HH head (Ref. illiterate): literate without formal education	-0.86887	-0.64126
	(0.738589)	(0.710293)
Literate formal: up to class X	-0.06557	0.08742
	(0.676717)	(0.611004)
Literate formal: higher secondary and above	0.19981	0.27578
	(0.673917)	(0.614078)
Occupation(Ref. no): Administration, executive or manager	0.72541	0.58689
	(0.512101)	(0.491137)
Clerk	1.94629***	1.90266***
	(0.354249)	(0.339253)
Service Staff	0.09129	0.05070
	(0.265721)	(0.267934)
Cultivator	0.40839**	0.49651***
	(0.201201)	(0.186370)
Agricultural labor	0.66855**	0.72873***
	(0.274253)	(0.262473)
Forest, fishing and mining	-0.08964	-0.09437
	(0.358967)	(0.354025)
Skilled labor	0.28971	0.31562*
	(0.197785)	(0.191302)
Occupation of head (Ref. no): Administration, Executive or manager	1.59779***	1.66430***
	(0.362433)	(0.357565)
Clerk	0.81073***	0.72873***
	(0.233829)	(0.222535)
Service staff	0.10650	0.04641
	(0.163417)	(0.172516)
Cultivator	-1.01625***	-0.99634***
	(0.139613)	(0.156198)
Agricultural laborer	-1.11788***	-1.25523***
	(0.151565)	(0.167023)

	(1)	(2)
Forest, fishing and mining	-1.28800***	-1.15357***
	(0.236245)	(0.226855)
Skilled labor	-0.57124***	-0.83753***
	(0.134664)	(0.146924)
Village availability (Ref. no response): SHG	2.90227	5.38916*
	(2.734031)	(3.122170)
No SHG	3.20339	5.50650*
	(2.733623)	(3.130072)
ICDS	-13.61533**	-10.55754*
	(6.698870)	(6.200764)
No ICDS	-16.29219**	-12.79331**
	(6.728568)	(6.178466)
PHC	4.89618***	3.23139**
	(1.355548)	(1.429589)
No PHC	3.37380**	1.68372
	(1.359472)	(1.421506)
Government dispensary	-0.04797	-0.51865
	(0.842405)	(0.841284)
No government dispensary	-0.01628	-0.35454
	(0.822145)	(0.839212)
Bank	5.05806***	2.40115
	(1.429115)	(1.532066)
No Bank	4.30752***	1.98232
	(1.428622)	(1.540521)
Chewing habits (Ref. never chewed) Pan: with or without tobacco	-0.87595***	-0.70161***
	(0.163090)	(0.163254)
Gutka: with or without tobacco	1.46369***	1.48048***
	(0.223983)	(0.214575)
Only tobacco	-0.05524	0.11007
	(0.179935)	(0.187375)
Ex-chewer	-0.78512***	-0.70208***
	(0.283474)	(0.259267)
Smoking habits (Ref. never smoked):any smoker	-0.65089***	-0.17909
	(0.163414)	(0.175556)
not known or not responded	-0.22408	0.10020
	(0.364472)	(0.365840)
Drinking habits (Ref. never drank): usual or occasional	2.18884***	1.54673***
	(0.192295)	(0.191564)
Ex-drinker	0.36712	0.23948
	(0.239400)	(0.238301)
Medical practitioner in village (Ref. no) : yes	0.01265	-1.28162***
	(0.459165)	(0.461526)
Medical practitioner per person in village	-5.33731	-9.98005*
	(5.882209)	(5.640047)
Any health facility in village (Ref. no): yes	0.42382***	0.44353***
	(0.084223)	(0.088408)
Distance of nearest bus station (km)	-0.01570***	0.01238***
	(0.002047)	(0.002564)
All weathered road to PHC (Ref. no): yes	1.05887***	0.80005***
	(0.115115)	(0.109468)
Schemes implemented in village (Ref. no): JSY	0.96828***	0.06406
	(0.142861)	(0.138202)
MDM (Ref. no): yes	0.44863***	0.42066***
	(0.100921)	(0.101282)
ICDS (Ref. no): yes	0.12659	-0.20294*
	(0.097873)	(0.108709)
Sanitation programme (Ref. no): yes	-0.78715***	-0.66482***
	(0.093430)	(0.102235)
RG drinking water (Ref. no): yes	-0.15447*	-0.17059**
	(0.083591)	(0.085309)

	(1)	(2)
Gram Rozgar Yojana (Ref. no): yes	-0.79927***	-0.41325***
	(0.109649)	(0.119092)
Per capita real development expenditure	-0.00008***	-0.00007***
	(0.000002)	(0.000002)
Percentage delay in MGNREGA payments (0-100)	0.00036	-0.00520**
	(0.002092)	(0.002609)
Total positive deviation in rainfall	0.36098***	0.25203***
	(0.009986)	(0.011801)
Absolute value of total negative deviation in rainfall	0.60805***	0.56670***
	(0.037110)	(0.038545)
PDS leakage (2011-2012)	0.04981***	-0.02537**
	(0.008323)	(0.010071)
MGNREGA leakage (2011-2012)	-0.15357***	-0.10512***
	(0.025518)	(0.025913)
Per capita net state domestic product at factor cost and constant prices	0.00002	-0.00004**
	(0.000013)	(0.000015)
Growth in Per capita net state domestic product at factor cost and constant prices	-0.43060***	-0.06089
	(0.079411)	(0.093738)
Group (Ref. Children below 5) Children 5-11 years	3.74601***	3.42684***
	(0.258901)	(0.254796)
Children 12-14 years	0.71502**	0.38184
	(0.332974)	(0.341231)
Non-pregnant women (15 years of age and above)	-0.68900**	-0.62840*
	(0.331088)	(0.330428)
Pregnant women	-1.82821	-1.78539
	(3.678738)	(3.616323)
Men (15 years of age and above)	-0.59076	-0.48455
	(0.359965)	(0.352604)
Predicted error from first stage PDS	-0.05960**	-0.08701***
	(0.025675)	(0.027022)
Predicted error from first stage MGNREGA	-0.11474***	0.09983***
	(0.009142)	(0.014943)
Constant	-47.78959***	-34.58026***
	(8.820028)	(9.409249)
Observations	482109	482109

(Bootstrapped with 300 repetitions)

	(1) b/se	(2) b/se	(3) b/se	(4) b/se
Haemoglobin differential (as % of WHO thresholds)	q20	q40	q60	q80
PDS participation rate (11-12)	0.08291***	0.01884	-0.02978**	-0.07068***
	(0.019103)	(0.015286)	(0.015115)	(0.018280)
MGNREGA participation rate (11-12)	0.14527***	0.11347***	0.10234***	0.08573***
	(0.012253)	(0.009657)	(0.010609)	(0.011818)
IAP district (Ref. no)	0.09395	0.06757	0.10702	-0.32967
	(0.311314)	(0.244863)	(0.258027)	(0.285314)
MGNREGA implemented in phase-1 (Ref. no)	-1.29811***	-0.94876***	-0.56530***	-0.14206
	(0.132476)	(0.118397)	(0.132397)	(0.132891)
MGNREGA implemented in phase-1 (Ref. no)	-2.64167***	-2.54769***	-2.13599***	-1.34251***
	(0.136334)	(0.108196)	(0.119561)	(0.141153)
Mild anaemia % in children DLHS 2	0.01857***	0.03139***	0.04530***	0.06466***
	(0.005449)	(0.004342)	(0.004284)	(0.005130)
Moderate anaemia % in children DLHS 2	-0.08853***	-0.07950***	-0.06374***	-0.05918***
	(0.003625)	(0.003059)	(0.003190)	(0.004035)
Severe anaemia % in children DLHS 2	-0.01597	-0.04324***	-0.07720***	-0.09338***
	(0.013423)	(0.011346)	(0.011811)	(0.014469)
Proportion of poor in district	1.90452***	0.66370**	-0.32300	-2.59342***
	(0.367703)	(0.280967)	(0.288108)	(0.323179)
Gender (Ref. Male) : Female	-0.83360***	-0.56276***	-0.59818***	-0.77149***
	(0.190022)	(0.147780)	(0.149458)	(0.190049)
Other	-3.78890	-7.43890	-10.96620*	-16.73786***
	(4.957492)	(5.644373)	(6.043380)	(5.234753)
Social Group (Ref: others): Scheduled Castes	-0.12131	-0.08297	-0.46366***	-0.74637***
	(0.141223)	(0.115577)	(0.106599)	(0.132791)
Scheduled Tribes	-2.19079***	-2.18309***	-2.28343***	-2.14224***
	(0.185690)	(0.156852)	(0.151142)	(0.178062)
Other Backward Classes	-0.47470***	-0.38017***	-0.50068***	-0.46594***
	(0.127011)	(0.107921)	(0.109993)	(0.121377)
Marital status (Ref. no response): Married	3.21693***	2.84612***	2.84610***	3.12528***
	(0.290657)	(0.248222)	(0.236330)	(0.285447)
Unmarried	2.94644***	2.60007***	2.39101***	2.22838***
	(0.249256)	(0.210989)	(0.212236)	(0.246333)
Pregnancy status (Ref. not pregnant): Pregnant	4.64323*	2.10864	2.39950	10.00226*
	(2.437796)	(3.658023)	(4.153740)	(5.786583)
Age in years	-0.05844***	-0.05160***	-0.05125***	-0.05214***
	(0.003654)	(0.002930)	(0.003110)	(0.003581)
Source of water (Ref. unimproved): Improved source	1.49825***	0.91884***	0.49184***	0.28246*
	(0.160216)	(0.139266)	(0.120804)	(0.154995)
Other	2.75526***	2.79396***	2.39526***	2.40822***
	(0.670824)	(0.516646)	(0.453462)	(0.796475)
Nature of toilet (Ref. open): Improved	-0.18551	0.02333	0.32112***	0.60907***
	(0.122109)	(0.085739)	(0.085415)	(0.095126)
Unimproved	-0.06632	0.05832	0.44544**	0.77240***
	(0.233972)	(0.178134)	(0.191486)	(0.220640)
Other	0.40798	-0.69999	-0.79662*	-1.58357***
	(0.644428)	(0.460410)	(0.455408)	(0.544565)

	(1)	(2)	(3)	(4)
House type (Ref. others): Pakka	0.69812***	0.69355***	0.51806***	0.40618***
	(0.110211)	(0.086189)	(0.091370)	(0.107691)
Cooking fuel (Ref. air polluting sources): Non indoor polluting sources	0.34356***	0.19959**	0.03139	-0.36227***
	(0.116296)	(0.088856)	(0.090652)	(0.098912)
Female share in Household	-0.00501*	-0.00957***	-0.01344***	-0.01629***
	(0.002633)	(0.002208)	(0.002053)	(0.002486)
Land ownership (Ref. No) : Yes	0.34770***	0.53801***	0.66985***	0.61196***
	(0.101921)	(0.085065)	(0.088747)	(0.101516)
Wealth Index (0-100)	-0.04068***	-0.03698***	-0.03573***	-0.03867***
	(0.002856)	(0.002274)	(0.002336)	(0.002819)
Chronic Illness (Ref. None): all other chronic illnesses	0.55745***	0.16707	-0.25943**	-0.63583***
	(0.145846)	(0.121138)	(0.122063)	(0.159296)
Inflammatory anaemia: gastrointestinal	0.41724	0.07447	-0.65822**	-1.23621***
	(0.550436)	(0.360750)	(0.326576)	(0.476113)
Education level (Ref. illiterate): Literate without formal education	-2.92532***	-2.76691***	-2.52604***	-1.50976***
	(0.614243)	(0.463567)	(0.474267)	(0.492054)
Literate formal: up to class X	-3.17627***	-2.58221***	-2.25476***	-1.01071**
	(0.554611)	(0.398874)	(0.402376)	(0.424196)
Literate formal: higher secondary and above	-2.59492***	-1.77210***	-1.17457***	0.71642*
	(0.570402)	(0.419028)	(0.418151)	(0.434150)
Education level of HH head (Ref. illiterate): literate without formal education	-1.87834	-0.48476	-0.05759	-1.62939
	(1.196381)	(0.960739)	(0.818854)	(1.049323)
Literate formal: up to class X	-1.24661	-0.09774	0.48729	-1.29991
	(1.017845)	(0.839337)	(0.694185)	(0.799950)
Literate formal: higher secondary and above	-0.94522	0.23787	0.77909	-1.01163
	(1.024953)	(0.841010)	(0.694800)	(0.807213)
Occupation(Ref. no): Administration, executive or manager	0.99833*	0.42189	0.73976	0.47318
	(0.563123)	(0.539280)	(0.503440)	(0.590994)
Clerk	1.50777***	1.94744***	2.23240***	2.43746***
	(0.362392)	(0.349972)	(0.331487)	(0.385535)
Service Staff	0.25523	0.32409	0.36608	0.35013
	(0.297493)	(0.261322)	(0.243957)	(0.315581)
Cultivator	1.03608***	0.71277***	0.33197*	0.57261***
	(0.257046)	(0.220694)	(0.197308)	(0.218792)
Agricultural labor	1.08496***	0.54400**	0.50291**	0.72769***
	(0.244122)	(0.215424)	(0.216306)	(0.241859)
Forest, fishing and mining	0.17612	0.17838	0.16486	0.19449
	(0.551311)	(0.449588)	(0.390994)	(0.483874)
Skilled labor	0.64091***	0.51613**	0.65194***	0.84828***
	(0.228154)	(0.204959)	(0.194779)	(0.217450)
Occupation of head (Ref. no): Administration, executive or manager	0.36100	0.66873**	0.64732**	1.17495***
	(0.395232)	(0.276159)	(0.311959)	(0.427228)
Clerk	0.37852	0.20636	0.50065**	0.69627**
	(0.249415)	(0.211214)	(0.234498)	(0.277980)
Service Staff	0.36608*	0.37134**	0.61751***	0.21123
	(0.219127)	(0.177843)	(0.184820)	(0.222673)
Cultivator	-0.16356	-0.43905***	-0.61241***	-1.31672***
	(0.190505)	(0.146486)	(0.151593)	(0.172317)
Agricultural labor	-0.26795	-0.47152***	-0.67446***	-1.30502***

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	(1)	(2)	(3)	(4)
	(0.210389)	(0.166148)	(0.166447)	(0.213491)
Forest, fishing and mining	-1.35918***	-1.31727***	-0.82423***	-0.78471**
	(0.343013)	(0.249167)	(0.266209)	(0.315329)
Skilled labor	0.41845**	0.04304	-0.18345	-0.76047***
	(0.193017)	(0.144256)	(0.142621)	(0.168135)
Village availability (Ref. no response)	10.47328**	4.51999*	3.18112	2.09226
: SHG	(4.197429)	(2.728593)	(3.057626)	(3.875280)
No SHG	11.05489***	4.99151*	3.55389	2.25974
	(4.186047)	(2.717739)	(3.050877)	(3.872681)
ICDS	-26.68286*	-35.30669***	-13.63331*	-0.42593
	(15.162046)	(8.986419)	(7.493771)	(7.293547)
No ICDS	-30.34467**	-37.40208***	-15.40783**	-2.29880
	(15.142355)	(8.960381)	(7.515195)	(7.324228)
PHC	7.49942***	5.53743**	2.31984	1.26445
	(1.760889)	(2.360181)	(2.114701)	(1.477881)
No PHC	6.56045***	4.64595**	1.34434	-0.03488
	(1.756792)	(2.357396)	(2.111533)	(1.470888)
Government dispensary	1.49322*	2.54520***	2.70527***	0.07585
	(0.879945)	(0.695744)	(0.972490)	(1.669847)
No government dispensary	1.25447	2.39340***	2.78306***	0.75322
	(0.868396)	(0.710013)	(0.988835)	(1.687172)
Bank	-1.93570	1.94792	4.90277***	7.07954***
	(1.629823)	(1.209646)	(1.607540)	(1.252282)
No bank	-2.35656	1.68004	4.53305***	6.56851***
	(1.624280)	(1.218121)	(1.615109)	(1.254057)
Chewing habits (Ref. never chewed)	-1.40819***	-0.79489***	-0.55163***	-0.26954*
Pan: with or without tobacco	(0.170861)	(0.138165)	(0.137526)	(0.156840)
Gutka: with or without tobacco	0.84074***	1.38952***	1.79819***	2.13015***
	(0.289659)	(0.244341)	(0.238757)	(0.267122)
Only tobacco	-0.22475	0.28888	0.01155	0.40640*
	(0.257631)	(0.203017)	(0.202347)	(0.216071)
Ex-chewer	-0.04508	-0.22656	-0.27164	-0.65222*
	(0.347218)	(0.267881)	(0.312525)	(0.360111)
Smoking habits (Ref. never smoked):	-0.87247***	-0.87736***	-0.73059***	-0.26757
any smoker	(0.211925)	(0.164045)	(0.163851)	(0.186787)
Drinking habits (Ref. never drank):	2.78384***	2.15897***	1.88935***	1.29946***
usual or occasional	(0.218776)	(0.174460)	(0.177391)	(0.196862)
Ex-drinker	0.55524*	0.41120	0.47714*	0.22743
	(0.308102)	(0.290470)	(0.267981)	(0.325177)
Medical practitioner in village (Ref.	1.13815**	2.57211***	1.26225**	-1.29130*
no): yes	(0.562520)	(0.447770)	(0.497528)	(0.690224)
medical practitioner per person in	-47.98665***	-15.51327**	20.57452***	36.08387***
village	(7.652503)	(6.107055)	(5.728625)	(5.238565)
Any health facility in village (Ref.	0.44336***	0.54015***	0.63880***	0.72913***
no):yes	(0.113788)	(0.090201)	(0.092061)	(0.095390)
Distance of nearest bus station (km)	-0.02912***	-0.01894***	-0.01067***	0.00146
	(0.003664)	(0.002502)	(0.002243)	(0.003088)
All weathered road to PHC (Ref.	1.09083***	0.95333***	0.72043***	0.70123***
no): yes	(0.126293)	(0.106302)	(0.102437)	(0.109357)
Schemes implemented in village (Ref.	0.71199***	0.65515***	0.59458***	0.96990***
no): JSY	(0.186417)	(0.146266)	(0.152884)	(0.179792)

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	(1)	(2)	(3)	(4)
MDM (Ref. no): yes	-0.11585	0.01036	0.35792***	0.97087***
	(0.137758)	(0.108386)	(0.110549)	(0.124210)
ICDS (Ref. no): yes	-0.15300	0.02873	0.08035	-0.02953
	(0.142199)	(0.108391)	(0.109282)	(0.125958)
Sanitation programme (Ref. no): yes	-0.32215***	-0.29977***	-0.26298***	-0.38015***
	(0.112208)	(0.091888)	(0.081563)	(0.104941)
RG drinking water (Ref. no): yes	-0.56238***	-0.63622***	-0.75687***	-0.83511***
	(0.115002)	(0.090685)	(0.087746)	(0.104869)
Gram Rozgar Yojana (Ref. no): yes	-1.43840***	-1.09332***	-0.72216***	-0.21172**
	(0.096808)	(0.079846)	(0.082119)	(0.098008)
Per capita real development expenditure	-0.00010***	-0.00009***	-0.00007***	-0.00005***
	(0.000004)	(0.000003)	(0.000003)	(0.000004)
Percentage delay in MGNREGA Payments (0-100)	-0.00190	0.00452***	0.00754***	0.00592***
	(0.002003)	(0.001650)	(0.001716)	(0.002021)
Total positive deviation in rainfall mean	0.27467***	0.32633***	0.37402***	0.42137***
	(0.016351)	(0.013097)	(0.013447)	(0.016805)
Absolute value of total negative Deviation in rainfall	0.63745***	0.49938***	0.48622***	0.46309***
	(0.028311)	(0.024072)	(0.023968)	(0.028095)
PDS leakage (2011-2012)	-0.10493***	-0.16228***	-0.21554***	-0.26104***
	(0.015150)	(0.012096)	(0.012252)	(0.014955)
MGNREGA leakage (2011-2012)	0.02780***	0.01825***	0.02948***	0.05167***
	(0.006237)	(0.005078)	(0.005404)	(0.005979)
Per capita net state domestic product at factor cost and constant prices	-0.00004***	-0.00001	0.00001	0.00003***
	(0.000011)	(0.000008)	(0.000008)	(0.000010)
Growth in Per capita net state domestic product at factor cost and constant prices	-0.50362***	-0.40372***	-0.26639***	-0.17560**
	(0.096369)	(0.074224)	(0.074546)	(0.086271)
Group (Ref. Children below 5): Children 5-11 years	5.60158***	4.61030***	3.20887***	1.35463***
	(0.340549)	(0.292687)	(0.264754)	(0.322967)
Children 12-14 years	2.91075***	1.63249***	0.29272	-1.93282***
	(0.428836)	(0.357231)	(0.338080)	(0.416069)
Non-pregnant women (15 years of age and above)	0.45694	-0.24073	-1.21492***	-2.10066***
	(0.416970)	(0.365270)	(0.349654)	(0.428873)
Pregnant women	-0.21887	2.19333	1.74473	-5.90987
	(2.462354)	(3.672049)	(4.155845)	(5.815286)
Men (15 years of age and above)	-0.17124	-0.08209	-0.44195	-1.34174***
	(0.443257)	(0.363318)	(0.340344)	(0.397273)
Constant	-48.57064***	-21.17069**	-31.95467***	-29.97154***
	(16.161427)	(9.512129)	(8.040434)	(8.442106)
Observations	482109	482109	482109	482109