Examining the Spillover Effects of Exposure to MGNREGS on Village Incomes and Household Consumption Expenditures

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Abstract

This paper examines the spillover effects of village-level exposure to MGNREGS on household consumption behaviour. Apart from creating a social safety net for vulnerable groups, MGNREGS also aims to strengthen the rural resource base by creating durable assets, which can impact the local village economy and influence household consumption. Using cross-sectional data for 189 villages across 13 states, the results show that a longer duration of village-level exposure to MGNREGS generates a positive village-wide income effect and increases household consumption expenditures. We posit that asset creation under MGNREGS is the pathway through which these positive spillover effects materialize. We examine the effects of two types of assets: a) standalone agricultural assets comprising water conservation, irrigation, renovation of water bodies and land development works, and b) a combination of agricultural and rural connectivity (roads) assets. The findings suggest that a greater exposure to MGNREGS led to an increase in both types of assets created between 2006-2016. Further, asset creation improved the local economy by increasing the village-wide incomes. A rise in the annual per capita household level total, food, and non-food consumption expenditures is also observed. Thus, this paper provides the first set of empirical evidence on the linkages between the duration of program exposure, asset creation, village incomes and household consumption expenditures. Our results also indicate the presence of heterogeneity in the positive effects of the two categories of assets on village incomes and household consumption expenditures. We find that building both agricultural and rural roads works results in a relatively greater income effect and increases consumption expenditures more than that observed for the standalone agricultural assets. Hence, this paper highlights the importance of building both agricultural and rural roads assets simultaneously to experience greater welfare gains.

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I. Introduction

Public works or workfare programs are interventions aimed at enhancing household welfare through the transfer of resources in return for employment. Workfare programs not only function as safety nets but also work to achieve the goal of building rural infrastructure. Thus, they contribute to the development of the local economy. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) is a public works program with a dual objective of providing rural households with employment on demand and villages with assets. Participants working under the scheme undertake manual, unskilled, and labour-intensive jobs that involve creating and maintaining village-level assets. In this way, exposure to the program facilitates the sustainable development of the village economy by strengthening the natural resource base of rural areas. It involves investing in local infrastructure by building and maintaining village-level assets. Some of the most common and popular infrastructural works built under MGNREGS include water conservation, irrigation facilities, renovation of traditional water bodies, land development activities, and rural connectivity or rural road works. The shelf of the projects for a village is recommended by the Gram Sabha and approved by the Panchayat. The Panchayats are required to execute a minimum of 50% of the works recommended by the Gram Sabha. A minimum of 60% of project costs is allotted towards wage payments to MGNREGS workers and the rest for material costs. To ensure transparency and accountability, grievance redressal mechanisms are also mandated, along with a social audit by Gram Sabha. All accounts and records relating to the scheme are required to be available for public scrutiny.

Water conservation works involve digging ponds, cleaning, and maintenance of water tanks, watershed development, and management, building water harvesting structures, etc. These assets provide access to clean drinking water and increase the supply of water for cultivation. Asset creation under irrigation includes works related to the development of micro and minor irrigation facilities. This can lead to an increase in the irrigated area under cultivation and improve the efficiency of farming activities. Further, it can enhance the water supply required for cultivation and incentivize farmers to grow water-intensive crops, especially in regions that rely on rainfall or those that face water shortages due to the prevailing agro-climatic conditions. This can increase agricultural productivity, acreage, and farm profits, thereby raising farm incomes.

Land development works are aimed at preparing and improving the quality of land for cultivation. These activities, especially those carried out on private lands, are primarily undertaken to benefit small and marginal farmers. Such works can enhance yields and enable farmers to grow a relatively greater number of crops, thereby increasing the returns from land. Rural road works under MGNREGS are undertaken to improve connectivity between the villages and markets. This has several benefits for the rural economy. Building roads increase access to agricultural input and output markets, extension services, and credit institutions by reducing the transaction costs associated with transportation. This incentivizes farmers to procure the agricultural inputs, increase the acreage under cultivation, and sell farm produce in the local markets or mandis. The improved access to product and credit markets can boost local economic activity by expanding trade and production opportunities and result in increased availability of food and non-food items. Households will have a greater choice of items for consumption, thereby enabling even the non-participants to increase their consumption expenditures.

Hence, village-level asset creation as a result of MGNREGS exposure can improve the local economy by having spillover effects that increase production and consumption. The duration of program exposure is crucial for the spillover effects of MGNREGS to materialize since assets such as roads, watersheds, wells, and irrigation facilities will take time to start having spillovers. The returns generated from the various types of public works will generate long-term income effects at the village level that go beyond the direct effects for program beneficiaries. This will enable households to improve their welfare by relaxing their budget constraint and maximizing the utility derived from consumption. This paper identifies and examines the long-term spillover effects of village-level exposure to MGNREGS on the village economy and household consumption behaviour. In addition to serving as a social safety net, MGNREGS also aims to strengthen the rural resource base by creating village-level durable assets. Thus, in this paper, we posit that village-wide asset creation under MGNREGS is the pathway through which these positive spillover effects materialize. Hence, we investigate the impact of asset creation on village-level income and household consumption expenditures. Particularly, we examine the exposure effects of MGNREGS on annual per capita total household consumption expenditures, food, and non-food expenditures. Thus, this paper provides the first set of empirical evidence on the linkages between the duration of program

exposure, village-wide durable asset creation under MGNREGS, village incomes, and household consumption.

Further, we hypothesize that the type of assets built under the program has varying village-wide income effects and welfare effects for households. For this purpose, two clusters of assets are considered. The first category of assets is standalone agricultural assets. These comprise works on water conservation, irrigation, renovation of traditional water bodies, and land development. The second category of assets consists of a combination of agricultural and rural road assets. Hence, we analyze the heterogeneous effects of different types of village-wide assets on village-level incomes and household consumption expenditure decisions.

Using cross-sectional household and village-level data for 189 villages across 13 states, we show that village-level exposure to MGNREGS has positive spillover effects on the local economy and household welfare. Since the program affects welfare outcomes by creating village-wide durable assets, it is important to recognize the interdependency of these variables. Hence, a 3-stage least squares (3SLS) method is employed to jointly estimate the relationship between the duration of exposure, village-level asset creation, village incomes, and household consumption expenditures. In the first stage, we use the area irrigated by government canals as a unique identifier to estimate the duration of program exposure. The findings from the first stage suggest that greater access to water from government canals for irrigation is associated with shorter program exposure.

The second stage involves the estimation of village-wide durable asset creation using the predicted duration of MGNREGS exposure obtained from the first stage. The findings show that longer village-wide exposure to the program results in greater village-level asset creation under MGNREGS. This is true for both categories of assets created. However, the share of only agricultural assets built is higher than the category comprising agricultural and road works. The unique identifier used in this stage is the number of years to the next Panchayat elections with 2006 as the base year. The results suggest that greater years to the upcoming elections decrease the percentage of the agricultural and rural connectivity assets combined. On the other hand, they increase the percentage of the standalone agricultural assets created.

In the third stage, we estimate the village incomes and household consumption expenditures using the predicted asset shares obtained from the second stage. The

findings show that asset creation leads to long-term increases in village-wide income and annual per capita household consumption expenditures. Further, we find that the positive effects on incomes and consumption vary for the two asset clusters. The asset combination comprising both agricultural and rural connectivity works contributes to a relatively higher increase in village income and household consumption expenditures. Hence, the results from this paper highlight the importance of building both agricultural and rural road assets simultaneously to experience greater welfare gains.

II. Welfare Impacts of MGNREGS: Evidence from Literature

The extant body of literature on the welfare impacts of MGNREGS suggests that the program has positive effects on consumption expenditures. Klonner and Oldiges (2014) employ a difference-in-difference methodology to estimate the causal impact of MGNREGS on monthly per capita consumption expenditures during the first two years of program implementation. They show districts that received the program in the first two phases experienced a decrease in food expenditures and a corresponding increase in non-food expenditures. Additionally, inequality measured by the variance of the monthly log per capita consumption expenditure declined by 18% and 11% in phase 1 and phase 2 districts respectively. They also observe that the welfare gains were significantly higher for the sub-sample of SC/ST households. Similarly, Bose (2017) provides "intent-to-treat" estimates which show that MGNREGS increased the rural household consumption expenditure in the range of 6.5 percent to 10 percent. Households belonging to the phase 1 districts experienced a shift from less expensive and low-nutrition foods (such as cereals) to more expensive and high-nutrition foods (such as lentils, dairy, meat, and fish).

Some literature also investigates the impact of the phased roll-out of MGNREGS for program beneficiaries, particularly for the state of Andhra Pradesh[2]. Using administrative data on household participation in MGNREGS, Deininger, and Liu (2019) found that the supplementary income earned by working under MGNREGS enabled beneficiary households to improve their welfare. While participant households belonging to the phase 2 districts increased their nutritional and energy intake, those belonging to the phase 1 districts additionally accumulated greater non-financial assets. Among the program participants, Ravi and Engler (2015) compared two groups of households i.e.,

[2] Andhra Pradesh is termed as a "star-state" due to its relatively better MGNREGS implementation records.

those who applied for and received jobs relative to those who applied but were denied work under MGNREGS. The former category of households witnessed an increase in food expenditures by 9.6% and non-food expenditures by 23%. Using the program feature of providing work within 15 days of registration as an instrument, Maity (2020) shows that households that worked 10 additional days under MGNREGS witnessed an increase in monthly per capita expenditures. The rise in expenditures was observed for a wide range of food items which included dairy and meat products, vegetables, fruits, and fish. Households that saw greater participation by women in MGNREGS also witnessed a rise in the expenditures on clothing and footwear for girls.

Though there is a body of literature assessing the welfare impacts of MGNREGS, it fails to identify the channels and pathways through which these effects manifest. One strand of literature exploits the phased rollout of MGNREGS and provides causal evidence on the short-term effects of early program implementation relative to late implementation. This paper recognizes and investigates the long-term exposure effects of MGNREGS which is measured by the duration of program exposure based on the actual month and year in which it was implemented. Going beyond the direct program impacts for beneficiary households, this analysis examines the spillover effects of program exposure. It identifies the creation of durable assets as an important pathway through which village-wide exposure to MGNREGS affects welfare indicators. The investigation of exposure-based spillover effects arising from asset creation is important since both participant and non-participant households are affected by them.

There is scant literature that has assessed the impact of asset creation under MGNREGS on indicators related to farming and cultivation. There is some evidence to suggest that infrastructural assets created under MGNREGS resulted only in a modest increase in the share of cash crops under cultivation (Shah, 2013). However, Deininger et al., (2016) do not find any effects of irrigation works on cultivation. There is also evidence that specific groups benefit from the heterogeneity in the assets created. The findings from Gehrke (2015) show that water conservation, irrigation, and land development activities carried out on their plots increased the time allocated by landowners on their farms. This led to a rise in the area under cultivation and agricultural yields. Similarly, the rural connectivity works increased the total hours of employment for casual agricultural workers by enabling greater mobility. This paper provides a comprehensive explanation of the spillover effects of MGNREGS arising from village-level durable asset creation

that result in long-term increases in village-wide incomes and household consumption expenditures.

There also exists some qualitative evidence on the quality of the assets created under the scheme. Aggarwal et al. (2012) conducted a small assessment of the economic effects of privately constructed wells[3] in the Purio Gram Panchayat of Ranchi district in Jharkhand. To gauge the gains obtained, they compared the cultivation costs incurred by farmers and the value received for their agricultural produce before and after the wells were constructed. They found that the wells constructed under MGNREGS increased cropping intensity, diversity of crops sown, and farm profits. Similarly, water conservation and land development works had positive effects on maintaining the local ecological balance by increasing groundwater levels, and the availability of water for irrigation and drinking purposes (Esteves et al., 2013). Ranaware et al. (2015) also found that water conservation, land development, and rural connectivity assets created under MGNREGS benefitted a large number of marginal and small farmers in Maharashtra[4]. These farmers also perceived the works to have had spillover effects on agricultural productivity. However, these assessments are based on the subjective perceptions of the surveyed households on whether MGNREGS works have benefitted them. The evidence seems to suggest that the works have been useful for the beneficiaries. However, there is a lack of consistent data available on the quality of MGNREGS assets created. This constrains us to incorporate variations in the quality of new assets in the empirical analysis undertaken in this paper.

III. Data and Descriptive Statistics

We use household and village-level data from the Socio-Economic Profile of Rural Households in India (SEPRI) survey to estimate the long-term exposure effects of MGNREGS on welfare outcomes. It is a comprehensive dataset that contains household and village-level data for 88,635 households across 189 villages, 83 districts, and 13 states of India. These villages were selected based on a continuing panel from the nationally representative Additional Rural Incomes Survey (ARIS) and Rural Economic Demographic Surveys (REDS) undertaken by the National Council for Applied

[3] Only completely constructed wells have been considered.
[4] 90% of the survey respondents found the works to be "very useful" or "somewhat useful". Only 8% of the respondents felt that the works were "useless".

Economic Research (NCAER) between 1969-2006[5]. The data for the SEPRI survey was collected by the Institute of Rural Management Anand (IRMA) in two phases. The first phase of data collection was conducted in 2013-2014 and covered the following 8 states- Andhra Pradesh, Bihar, Chhattisgarh, Haryana, Jharkhand Madhya Pradesh, Rajasthan, and Tamil Nadu. The second phase was carried out in 2015-2016 and covered the remaining 5 states of Gujarat, Maharashtra, Odisha, Uttar Pradesh, and West Bengal. The questionnaires of the SEPRI surveys have been developed following those of the REDS 1999 and 2006 surveys.

The SEPRI survey has a listing questionnaire that consists of a complete enumeration of all households in the sample villages. It contains detailed information on the household composition such as the household size, and the number of females, dependent, and secondary educated members in the household. Additionally, it also provides information on the household head characteristics which include the gender, age, education, and marital status of the head. Further, data on household land holdings, asset ownership, and inheritances are also tabulated. This enables us to control for household and household head characteristics while estimating the household-level regressions. One of the unique features of the SEPRI survey is that it comprises questions on the annual income earned by a household from various sources which include income from agriculture, livestock, wages, salary, and non-farm business activities. This data on household-level income can be further aggregated at the village level to compute the village income and estimate the income effect generated due to spillovers from MGNREGS exposure.

Further, the listing sheet contains a section detailing the item-wise household consumption expenditures for goods falling under several categories such as food, durables, non-durables, consumer services, medical and health expenditures. Under the category of food items, the survey provides data for expenditures on a wide range of food items which include cereals, pulses, vegetables, fruits, dairy, meat, fish and chicken, oil, and sugar. The expenditure data for food items is based on a recall period of 30 days. Thus, the survey provides data on the monthly expenditure incurred on each food item for 30 days before the date and month in which the household was interviewed. We aggregate the expenditure data on all food items to arrive at the total household food

[5] There are four states that are a part of the REDS surveys but could not be surveyed under the SEPRI rounds due to operational and logistical constraints. These states are Himachal Pradesh, Karnataka, Kerala, and Punjab.

consumption expenditure. Expenditures under the non-food category comprise the annual expenditure incurred on items such as durables, non-durables, consumer services, education, and health care. The expenditures on the above categories of goods and services are aggregated to arrive at the total annual non-food expenditure. We multiply the monthly food expenditure by 12 to obtain an estimate for the annual household food expenditure. The total annual household expenditure is a sum of the annual food and non-food expenditures. Finally, the annual expenditures are divided by the household size to arrive at the annual per capita expenditures. The listing sheet of SEPRI also provides household-level data on the actual date, month, and year of job card issuance. We use this data to obtain the month and year of the first job card issued to a household in a given village and consider that as an indicator of the actual program implementation.

The village questionnaires contain the enumeration of village-wise information for all the sample villages. We use the REDS 2006 village questionnaire to obtain data on the villages with Pradhan positions reserved for women, remoteness, and irrigation indicators during the initial year of MGNREGS implementation. We use the information on the distance from the nearest bus stand to compute a bus index[6]. This variable is used in the estimations as an indicator of remoteness. The questionnaire contains information on whether a Panchayat had reservations for female heads in 2006. Further, it also provides the year in which Panchayat elections were held. This data is available for the previous, current, and upcoming Panchayat elections. It allows us to construct the variable depicting the number of years to the next Panchayat elections, with 2006 as the reference year. The village schedule also includes a section providing details on the total village area (in acres), irrigated area, and the various sources of irrigation. This enables us to obtain data on the area irrigated by government canals.

The village schedule of SEPRI contains detailed information on various features of MGNREGS which also includes asset creation. The survey provides asset-wise (land development, water conservation, rural connectivity, etc) the number of works undertaken and completed for each of the 189 villages. This data is available for all years between 2006-2016 which facilitates the estimation of the long-term effects of asset creation on the village and household welfare indicators. We group the assets built under MGNREGS into two categories. The first type of assets comprises agricultural assets

[6] Bus index=Distance to the nearest bus stand/Maximum distance to the nearest bus stand amongst all sample villages.

which involve water conservation, irrigation, renovation of water bodies, and land development works. The second category of assets is a combination of agricultural and rural connectivity assets. Hence, these comprise all agricultural works and rural road assets. We obtain the share of the two types of assets in the total number of MGNREGS works completed in a village.

Table 1 depicts the village-level summary statistics for the years 2006 and 2016. Panel A represents the village-wide characteristics during the initial phase of MGNREGS implementation. About 47% of the villages had a bus stand within the village. Of the total area irrigated, only 31% of the area was irrigated by government canals before MGNREGS implementation. This highlights the importance of building village-wide assets that increase the availability of water for cultivation. An average of 28% of the villages had reservations for females as panchayat heads. However, this is lower than the mandated policy of reserving 33% of the panchayat head positions for women. As of 2006, the next panchayat elections in the sample villages were more than 3 years away. Panel B represents the descriptive statistics of the MGNREGS exposure and asset creation indicators for 2016. The average duration of village-wide exposure to MGNREGS is 102.5 months, or a little more than 8.5 years. Between 2006 and 2016, an average of 45% of all assets created, were only agricultural assets. These agricultural assets include works on water conservation, irrigation, land development, and renovation of traditional water bodies. Further, the combination of agricultural and rural connectivity (road) assets comprised nearly 70% of the total assets built under the scheme. These statistics indicate that the aim of asset creation under MGNREGS is to ensure the development and sustainability of agriculture and simultaneously facilitate access to markets to enhance household welfare.

Table 1: Descriptive Statistics- Village Characteristics

VARIABLES	(1) Mean	(2) SD
Panel A: Village Characteristics	***2006***	
Female reservations (Yes=1)	0.280	0.450
Area irrigated by government canal (acres)	227.7	540.7
Share of land irrigated by government canal	0.309	0.403
Whether the village has a bus stand (Yes=1)	0.471	0.500
Number of years to next panchayat election	3.212	1.669
Observations	189	
Panel B: Village Characteristics	***2016***	
Village income (log)	16.66	0.875
Village area (acres)	1742	1679
Whether the village is electrified (Yes=1)	0.984	0.125
Whether the village has a public financial institution (Yes=1)	0.524	0.501
Duration of village exposure to MGNREGS (months)	102.5	15.30
Percentage of only agricultural assets created	44.70	30.53
Percentage of agricultural and rural connectivity assets created	69.46	23.70
Observations	189	

Table 2 presents the household-level descriptive statistics. The household head characteristics indicate that an average of 13.3% of the households are headed by females. The average age of the head is around 50 years and 82.3% of the heads are married. On average, household heads have completed 4.5 years of education. This indicates that the average household head has been educated only till primary school. The statistics on the household composition show that the share of members who attained a minimum of secondary school education was 35.4% on average. The average rural household in this sample comprises 48.6% of females. Further, more than 50% of the household members are dependents. Land ownership statistics reveal the average size of land holding to be 0.3 acres. This depicts that the average household owning cultivable land belongs to the marginal farmer category. The share of irrigated land owned is close to 39% which suggests the need to improve irrigation facilities in the village. The statistics on inheritance show that more than 87% of households inherited assets.

Table 2: Descriptive Statistics- Household Characteristics

VARIABLES	(1) Mean	(2) SD
	2016	
Female head (Yes=1)	0.133	0.339
Age of head	49.86	13.95
Years of education of head	4.475	4.556
Share of HH members with secondary education	0.354	0.306
Married head (Yes=1)	0.823	0.382
Female share	0.486	0.194
Per capita land (acre)	0.301	0.645
Share of irrigated land	0.389	0.483
Dependency ratio	0.511	0.273
HH Inheritance (Yes=1)	0.872	0.334
HH Split (Yes=1)	0.215	0.411
Observations	88,775	

IV. Empirical Methodology

In this section, we describe the empirical framework employed to estimate the spillover effects of village-level exposure to MGNREGS. We posit that village-level durable asset creation is the pathway through which the spillover effects generate village-wide income effects and influence household consumption expenditures. Asset creation under MGNREGS will be determined by the duration of program exposure. A longer program exposure is expected to result in greater village-wide asset building. This would generate village-wide income effects and impact household consumption expenditures. Since the duration of exposure affects village-incomes and household expenditures simultaneously via asset creation, the residuals of the individual equations may be correlated due to the interdependency of the outcomes. Individual estimation of the system equations fails to incorporate the information obtained from the joint determination of the variables thus causing the estimates to be inefficient. Thus, the duration of exposure, village-wide durable assets created, village income, and consumption expenditures need to be jointly estimated. The Seemingly Unrelated Regressions (SUR) methodology involves the simultaneous estimation of equations and accounts for contemporaneous correlation in

the error covariances across equations (Zellner, 1962). It also accounts for the correlation between the right-hand side predictors and the error terms. However, it assumes all independent variables in each of the equations to be exogenous. The endogeneity involved in estimating the long-run welfare impacts of program exposure arising from asset creation implies that the SUR framework cannot be employed for estimation. The estimates obtained from such an estimation would be biased and inconsistent.

The Three-Stage Least Squares (3SLS) method combines the properties of SUR and 2SLS and allows the joint estimation of the equations controlling for endogeneity (Zellner and Theil, 1962). The first stage solves for all endogenous variables by estimating them as a function of the exogenous variables. The fitted values of each endogenous variable obtained from the system OLS or SUR reduced form estimations are used as instruments. In the second stage, the equations are estimated individually using the fitted values obtained from the first stage. In the third stage, the covariance matrix obtained from the error terms of the second stage is employed as a weighting matrix and the instruments from the first stage are used for the joint estimation of the system of equations. 3SLS estimation accounts for the cross-correlation among all equations of the system. The coefficients obtained from the system estimation have smaller standard errors relative to those obtained from estimating individual equations. Hence, joint determination of the system equations ensures that the 3SLS estimates obtained are more precise and asymptotically more efficient, and using instruments to predict the endogenous variables provides consistent estimates.

Hence, using a 3SLS estimation framework, we jointly estimate the four outcome variables in a system of simultaneous equations. These outcome variables are the duration of village-level exposure to MGNREGS in months, the percentage of the two types of assets created under MGNREGS between 2006-2016, village income (in ln) in 2016, and the annual per capita household consumption expenditure. Before proceeding with 3SLS, we also estimate the system of equations separately using the OLS and 2SLS methods. Hausman's model specification test is used to determine the choice of the estimation strategy. The Hausman test statistic indicates that 3SLS is preferred over the other two single equation estimation methods. A comparison of the results from the three sets of estimations is provided in the Appendix of this paper.

Estimating the Duration of Village-Level Exposure to MGNREGS

$$D_v = \alpha_v + \lambda X_v' + \tau Z_{1v} + \varepsilon_v \quad (1)$$

Here, D_v is the duration of exposure of village v to MGNREGS in months. The duration of program exposure is computed based on the actual implementation of the program. This is indicated by the exact date, month, and year in which the first job card was issued in the village.

MGNREGS was implemented in a phased manner between 2006-2008. The assignment of districts to the three phases was done based on a backwardness index proposed by the Planning Commission of India in 2003 which comprised two economic components namely the daily wage rate for agricultural workers and the agricultural productivity per worker and a distributional component i.e., the proportion of SC/ST population in a district. The districts which had a lower value of the index were supposed to receive the program in the initial phases. Based on this classification, 200 districts were expected to receive the program by February 2006, an additional 130 districts by April 2007, and the remaining districts by April 2008.

However, in practice, it has been observed that though several districts were assigned to a particular phase of the program, they implemented it only at a much later date. Similarly, those districts that were expected to receive the scheme in phase 3 got exposed to MGNREGS in 2006 or 2007. In our sample of 189 villages, 73 villages come under the phase 1 categorization, 32 villages fall under phase 2, and the remaining 84 under phase 3. However, the actual program implementation indicates that only 63 phase 1 villages in the sample issued the first job card in 2006, while the remaining 10 did so after 2006. Further, 14 and 19 villages from the second and third phases issued the first job card in 2006 itself. Moreover, the phase-wise information on the implementation only signifies the year in which the program was expected to be implemented. This will not be very useful in constructing the duration variable since the length of exposure can be measured only by the number of years elapsed between the year in which the village was interviewed and the year of program implementation. The values for the duration of exposure created in this manner will only take values integer values between 5-10. The variation in duration that arises because of the different months of job card issuance, especially in the same year cannot be captured.

The SEPRI datasets provide the actual month and year in which the first job card was issued to a household in the village. Similarly, information on the month and year in which all households in a particular village were interviewed is also recorded. We obtain the duration of village-level MGNREGS exposure by computing the time elapsed between the month and year of the interview and first job card issuance respectively. Hence, villages that issued the first job card in 2006 have greater program exposure compared to villages that issued the first job card in 2007, 2008, or later. This way of computing the exposure variable also captures the variations in duration that emerge from program implementation in the same year but in different months. For instance, a village that implemented the program in June 2006 will have 6 additional months of exposure relative to a village that received MGNREGS in December 2006.

X_v' is the vector of village-level covariates in 2006, the year when MGNREGS implementation began. These include female reservations for Pradhan and the bus index.

Female reservation for Pradhans is a legislative policy aimed at improving the participation of women in contesting for leadership positions at the Gram Panchayat. In 1993, the 73rd amendment to the Indian Constitution mandated that 1/3rd of all Panchayat head positions be reserved for women to address the issue of the under-representation of women in local bodies. The allocation of seats that will be reserved is required to be random. Hence, the exogenous variation can be exploited to examine how villages reserved for women Pradhan impact the duration of program exposure. One of the responsibilities of a Pradhan is regarding the selection of beneficiaries of welfare programs. Since the beneficiary households are issued job cards during the process of enrolment under MGNREGS, the reservation of seats for women Pradhan is expected to affect the job card issuance process. Literature suggests that having a woman Pradhan has a "role model effect" that encourages greater female participation in the labour market (Duflo, 2005; Iyer et al., 2012). In addition, female members feel empowered to raise their concerns and experience benefits accruing from MGNREGS (Deininger et al., 2020). Bose and Das (2018) provide evidence from Uttar Pradesh which suggests that the demand for work under the scheme and the issuance of job cards was higher in reserved Panchayats[7]. Thus, female reservations are expected to affect the program

[7] However, these trends were observed only for the districts belonging to phase 1 and Panchayats that had woman head in the previous term.

duration by ensuring the earlier issuance of the first job card. This motivates us to include female reservation as a determinant of the duration of program exposure in equation 1.

The second village-level covariate is the bus index which is an indicator of the remoteness of the village from the nearest bus stand. The bus index variable is computed as the ratio of the distance from the nearest bus stand to the maximum distance to the nearest bus stand amongst all sample villages. Hence, the values of the bus index indicate the remoteness of a village relative to the most remote village in the sample. This variable takes values ranging between 0 and 1. The bus index variable takes a value of 0 when the distance to the nearest bus stand is 0km i.e., the bus stand is located within the village. For villages that do not have a bus stand within the village, the index takes values greater than 0. As the distance of a village to the nearest bus stand increases, the value of the bus index will also increase. Hence, a higher value of the bus index signifies greater remoteness. Out of the 189 sample villages, the maximum distance to the nearest bus stand is 31km. So, when the bus index value is equal to 1, it represents the most remote village in the sample.

In the absence of adequate employment opportunities available within the village, households, especially those reliant on casual labour, are forced to travel and search for work outside the village. Individuals commonly use buses as a mode of transport to travel to nearby places to find employment. Residents in villages that do not have a bus stand, face greater transaction costs in the form of increased travel time and transportation costs to reach the nearest bus stand. It adds to the search costs of finding employment for casual workers when they are out of work. One of the features of MGNREGS is the sourcing of employment in the same village, particularly within a 5-kilometer radius. This is to ensure that the costs of searching for jobs outside the village, including the costs of accessing bus facilities, are eased for program beneficiaries. The relatively more remote villages or those with a longer distance to the nearest bus stand are expected to witness early job card issuance and hence, greater program exposure. Therefore, the bus index variable is an important determinant of village-level program exposure. The bus index variable is standardized, and the z-scores are used in the regressions.

Z_{1v} is the unique identifier used to estimate the duration of exposure in the first stage. This variable is the cultivable area in a village that is irrigated by government canals. Villages that are located in the delta area have better access to canal water. Evidence

from Asher et al., (2022) suggests that settlements having access to canal water have a higher irrigated area under cultivation and grow more water-intensive crops. They are also able to obtain greater yields during the dry winter or rabi season. Additionally, these areas also experience a significantly higher population density which increases the demand for agricultural labour but does not alter the non-farm sector. Based on this, it can be hypothesized that in these areas, the demand for work under MGNREGS can be lower. Hence, land that has access to government canals can be used to construct the instrument for the first stage of estimation and subsequently predict the duration of village-level exposure to MGNREGS. Since the SEPRI survey provides data on the sources of irrigation for each village in the sample, we use the area irrigated by government canals as the instrument to predict the duration of MGNREGS exposure. An increase in the area irrigated by government canals is expected to lower the length of program exposure.

Estimating Village-Level Asset Creation under MGNREGS

In addition to enhancing livelihood security by providing employment on demand, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) envisages strengthening the rural natural resource base by creating durable assets in villages. Out of the total works to be undertaken, Panchayats are required to ensure that a minimum of 50% of the works recommended by the members of the Gram Sabha[8] are executed. Further, the Act suggests that atleast 60% of the total works to be taken up in a district should be productive assets directly linked to improving agriculture and allied activities through the development of land, water, and trees[9]. Particularly works related to land development, constructing water harvesting structures, and watershed management to harness rainwater are the central focus of MGNREGS works aimed to enhance farm productivity and sustainability of agriculture. Additionally, improving rural connectivity by undertaking rural road works is also an important feature of MGNREGS asset creation. Since the Act itself recommends allocations of particular types of public works as a percentage of total works to be undertaken, we employ the shares of asset mixes in the analysis. Equation 2 estimates how the duration of village-level program exposure affects village-level assets created under MGNREGS.

[8] All adult members of village are members of the Gram Sabha.
[9] Subject to the geographical constraints and local area requirements.

$$A_v = \gamma_v + \pi R_v + \sigma \widehat{D}_v + \omega Z_{2v} + \mu_v \quad (2)$$

In equation 2, A_v is the percentage of a particular type of asset category in the total assets created between 2006-2016 in village v. In this paper, we examine the effects of two categories of assets on village-level income and per capita household consumption expenditures. These are a) standalone agricultural assets comprising water conservation, irrigation, water body renovation, and land development works (asset category 1), and b) a combination of agricultural and rural connectivity works (roads) (asset category 2). The system of equations is computed separately for the two types of asset categories.

$\widehat{D}_v$ is the predicted duration of exposure to MGNREGS for village v obtained from equation 1. A longer duration of exposure is expected to result in greater village-wide durable asset creation.

R_v is a dummy variable that takes the value 1 if village v falls under a Panchayat that has female reservations for the Pradhan.

The decisions related to the shelf of MGNREGS projects are decided by the Gram Panchayat based on the recommendations from the Gram Sabha members. There is evidence to suggest that in reserved villages, female Pradhans provide public goods that are preferred and valued more by women. Chattopadhyay and Duflo (2004) found that among the issues discussed in Panchayats, women residents in West Bengal had a higher preference for water and roads and a lower preference for schools. In the case of Rajasthan, women were found to rank water issues higher than roads. In line with these preferences, they provide evidence that reserved panchayats in West Bengal witnessed greater investment in water and roads. On the other hand, Rajasthan saw higher investment in water but less in the case of roads. For Uttar Pradesh, Bose, and Das (2018) show that reserved Panchayats belonging to the phase 1 districts experienced a 7% increase in the number of water control and harvesting works. However, the results from Afridi et al., (2017) indicate the existence of corruption and irregularities in the administration and delivery of the scheme in panchayats reserved for women. They attribute this trend to the lack of political and administrative experience observed in the case of women heads. But Panchayats reserved for women perform better on some program aspects if the Pradhan has prior political experience. Hence, reservations for women Panchayat heads can be expected to impact the creation of durable assets under MGNREGS.

Z_{2v} is the unique identifier that is used to estimate village-level asset creation in the second stage. This variable is the number of years to the next Panchayat election (with 2006 as the reference year). The motivation for using the number of years to the next Panchayat election as a covariate in the second stage stems from the work by Nordhaus (1975) who explains the opportunistic behaviour of political representatives and parties before elections. By employing a theoretical framework of political business cycles, he shows that incumbent heads manipulate policies closer to elections to increase their probability of getting re-elected. Following this behaviour, the incumbent Pradhans may choose to implement more MGNREGS works closer to the next election, given that they are responsible for executing these works. However, the aspiration to seek, win and maintain the majority votes may prompt the incumbents to use populist welfare schemes benefitting the poor to their advantage immediately after coming to power (Khemani, 2010). In the context of MGNREGS asset creation, the incumbents may be anticipated to increase the share of the asset mix preferred by the majority population in the village. This behaviour can be witnessed even when the next cycle of elections is not scheduled in the immediate future. Additionally, using a theoretical model, Casini et al., (2017) show that an elected representative whose aim is to maximize the probability of getting re-elected invests in public good provision only when there is collective action on the part of the citizens in voicing their demand. Hence, assuming no collective action scenario, asset creation is anticipated to have a negative relationship with the number of years to the next Panchayat elections.

Estimating the Village-Wide Income Effect

The primary focus of MGNREGS asset creation is to strengthen the rural agricultural resource base since a significant proportion of rural households are reliant on agriculture for their livelihoods. This has led to agriculture-based works such as water conservation, land development, micro irrigation, and renovation of traditional water bodies occupying the centre space in MGNREGS-related asset creation. These community-wide assets have the potential to enhance agricultural productivity by improving the availability of water for farm households in the village, especially during periods of rain deficiency. Additionally, water conservation works can also ensure the supply of clean drinking water which would benefit all households in a village. The construction of roads can improve the access to markets, and credit institutions and boost local trade for both program beneficiaries and non-beneficiaries. Thus, the returns from MGNREGS public

works can result in long-term income effects at the village level. Equation 3 empirically estimates the effect of community-based durable asset creation under MGNREGS on village-wide incomes.

$$Y_v = \theta_v + \varphi W_v' + \beta \hat{A}_v + \vartheta_v \quad (3)$$

In equation 3, Y_v is the income of village v (in ln) in 2016. $\hat{A}_v$ represents village-wide asset creation measured by the predicted values of each asset type as a share of the total MGNREGS assets (in percentage terms) created in village v. These predicted values of the two asset categories are obtained from estimating equation 2 W_v' is the vector of village characteristics for village v in 2016 such as the presence of a public financial institution within the village, access to electricity, and village area (in ln).

Estimating the Household Consumption Expenditures

$$C_{iv} = \delta_{iv} + \beta \hat{A}_v + \rho H_{iv}' + \epsilon_{iv} \quad (4)$$

Here, C_{iv} is the annual per capita consumption (log) expenditure of household i in village v in 2016. We examine the spillover effects of asset creation on the total household consumption expenditure as well as food and non-food consumption expenditures. $\hat{A}_v$ is the predicted share of each asset type (in percentage terms) created in village v. These predicted asset shares are obtained from equation 2. H_{iv}' is the vector of household and village level covariates such as gender, age, and squared age of head, the share of females, share of members educated more than primary school, the share of irrigated land owned, household splits, inheritance, and bus index for household i in village v in 2016.

Thus, the system of simultaneous equations to be estimated using the 3SLS methodology is given below.

$$D_v = \alpha_v + \lambda X_v' + \tau Z_{1v} + \varepsilon_v \quad (1)$$

$$A_v = \gamma_v + \pi R_v + \sigma \widehat{D}_v + \omega Z_{2v} + \mu_v \quad (2)$$

$$Y_v = \theta_v + \varphi W_v' + \beta \hat{A}_v + \vartheta_v \quad (3)$$

$$C_{iv} = \delta_{iv} + \beta \hat{A}_v + \rho H_{iv}' + \epsilon_{iv} \quad (4)$$

V. Econometric Results

Estimating the Duration of Village-Level Program Exposure

The coefficients from the first-stage estimation of duration of exposure to MGNREGS using village-level covariates observed during the initial year of MGNREGS implementation are presented in columns (1) of Tables 3 (asset type 1) and 4 (asset type 2). The results suggest that an increase in the land irrigated by government canals reduces the duration of exposure. Hence, there exists a negative relationship between the village area irrigated by government canals and the duration of exposure to MGNREGS. The estimates are statistically significant at 1% and follow similar trends for the two sets of system equations involving the different types of assets. However, female reservation for Pradhan is positively associated with the duration of exposure. The findings show that reserved villages have more than 2 additional months of program exposure compared to villages with no reservations. The regression estimates also reveal that greater remoteness is associated with longer MGNREGS exposure. A one standard deviation rise in the bus index results in a little more than a 1-month increase in the duration of village-wide program exposure. This indicates that villages that are relatively farther from the nearest bus stand also have slightly greater program exposure.

Estimating Village-Level Asset Creation under MGNREGS

The second stage estimates from the regression of village-level durable asset creation under MGNREGS between 2006 and 2016 on the predicted duration of exposure obtained from the first stage, the number of years to the next panchayat election as of 2006, and female reservations are tabulated in columns (2) of Tables 3 and 4. The coefficients associated with the predicted duration of village-wide exposure to MGNREGS suggest a strong positive relationship between exposure and village-level asset creation. An additional 10 months of program exposure led to a 13% increase in the share of only agricultural assets created. However, a rise in the duration of exposure by 10 months increased the share of the assets consisting of both agricultural and road works by 4.5% only. Thus, in villages that received the program earlier the share of the standalone agricultural assets built was almost triple the share of the asset mix aimed at improving agriculture and connectivity. This trend could again be attributed to the fact that the MGNREGA places a greater emphasis (at least 60% of the total works in a district) on building assets related to agricultural and allied activities. Since the rural

economy is primarily dependent on agriculture, a greater share of standalone agricultural assets built could also reflect that these assets are preferred[10] more by the households.

The effects of female reservations and election indicators on village-level asset creation under MGNREGS display some interesting trends. The coefficients indicate that female reservations have a strong positive and statistically significant effect on asset creation. This trend is observed for both categories of assets. It is found that 1.14% more agricultural assets were created in reserved villages relative to the unreserved villages. Having female reservations for Pradhan also increased the combination of agricultural and road assets by 3.73%. These results indicate that female Pradhans aim to improve both agriculture and connectivity simultaneously by creating a higher share of the second asset type. The trends reflect that women have a higher preference for the second category of assets and hence the reserved villages witness a greater increase in the same.

[10] Panchayats are required to account for the preferences of Gram Sabha member while planning the MGNREGS works to be undertaken by executing a minimum of 50% of the total works based on their recommendations.

Table 3: Spillover Effects of Village-Level MGNREGS Exposure on Village Income and Total Household Consumption Expenditures (Asset Category 1)

VARIABLES	(1) Duration	(2) Assets Created	(3) Village Income (ln)	(4) Total Expenditure (ln)
Female reservations-current panchayat (Yes=1)	2.330***	1.141***		
	(0.0534)	(0.132)		
Area irrigated by government canal (ln)	-0.452***			
	(0.0126)			
Bus index	1.185***			
	(0.0289)			
Duration of MGNREGS exposure		1.291***		
		(0.0231)		
No of years to next panchayat election		1.449***		
		(0.0698)		
Assets created (WC, IRR, RWB, and LD)			0.0396***	0.00276***
			(0.000501)	(0.000394)
Electricity in the village (Yes=1)			1.033***	
			(0.0201)	
Area of the village (ln)			0.439***	
			(0.00355)	
Public financial institution within the village (Yes=1)			0.497***	

VARIABLES	(1) Duration	(2) Assets Created	(3) Village Income (ln)	(4) Total Expenditure (ln)
			(0.00717)	
Constant	122.2***	-155.2***	12.19***	8.790***
	(0.176)	(2.865)	(0.0372)	(0.0179)
Observations	88,650	88,650	88,650	88,650
R-squared	0.901	0.673	0.466	0.330
District FE	YES	YES	YES	YES

Notes to Table 3: Columns (1) and (2) report results from the first, and second-stage regressions respectively. Columns (3) and (4) report results from the third-stage regressions. The dependent variables of each stage are listed at the top. The first and second stage regressions are at the village level. The third stage income and consumption regressions are at the village and household level respectively. Asset category 1 comprises only agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), and land development (LD) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Spillover Effects of Village-Level MGNREGS Exposure on Village Income and Total Household Consumption Expenditure (Asset Category 2)

VARIABLES	(1) Duration	(2) Assets Created	(3) Village Income (ln)	(4) Total Expenditure (ln)
Female reservations- current panchayat (Yes=1)	2.391***	3.727***		
	(0.0539)	(0.110)		
Area irrigated by government canal (ln)	-0.385***			
	(0.0128)			
Bus index	1.107***			
	(0.0294)			
Duration of MGNREGS exposure		0.453***		
		(0.0181)		
No of years to next panchayat election		-0.444***		
		(0.0568)		
Assets created (WC, IRR, RWB, LD, and RC)			0.0488***	0.00644***
			(0.000519)	(0.000491)
Electricity in the village (Yes=1)			0.627***	
			(0.0200)	
Area of the village (ln)			0.489***	
			(0.00313)	
Public financial institution within the village (Yes=1)			0.513***	
			(0.00665)	

VARIABLES	(1) Duration	(2) Assets Created	(3) Village Income (ln)	(4) Total Expenditure (ln)
Constant	122.1***	2.244	9.590***	8.431***
	(0.176)	(2.230)	(0.0391)	(0.0344)
Observations	88,650	88,650	88,650	88,650
R-squared	0.901	0.739	0.519	0.313
District FE	YES	YES	YES	YES

Notes to Table 4: Columns (1) and (2) report results from the first, and second-stage regressions respectively. Columns (3) and (4) report results from the third-stage regressions. The dependent variables of each stage are listed at the top. The first and second stage regressions are at the village level. In the third stage, income and consumption regressions are at the village and household- levels respectively. Asset category 2 comprises a combination of a) agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), land development (LD), and b) rural connectivity (RC) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

However, the effects of the years to the upcoming panchayat elections on asset creation differ for the two categories of assets. The results for the first set of assets indicate the presence of a positive and statistically significant relationship between the next panchayat elections and the creation of standalone agricultural assets. Villages witness a 1.45% increase in the creation of the first cluster of assets comprising only agricultural assets with every 1-year increase in the gap between two election cycles as observed in 2006. These results indicate that as the number of years to the next elections increases, incumbent heads focus on creating more assets belonging to the first category. Since a majority of the rural households are dependent on agriculture, the Pradhans will build more of the standalone agricultural assets to gain and maintain the majority voter base that would help them to get re-elected. Given that the long-term effects of the assets take time to materialize, the incumbents will start executing these works immediately after coming to power. On the other hand, there exists a negative relationship between the number of years to the next Panchayat elections and the percentage of the second category of assets created. There is a marginal decline of 0.45% in the assets built under the second category as the duration between the two Panchayat elections (relative to 2006) increases by 1 year. This could be attributed to the trade-off between the two asset types, wherein the share of the second category of assets declines with every 1-year increase in the years to the next election. This implies that incumbents implement public works related to the second category of assets closer to elections to gain more votes.

Estimating Income and Consumption

Column (3) of Tables 3 and 4 depicts the long-term effects of asset creation of the two types on village-level income. It is observed that asset creation of both types generates a positive village-wide income effect. A 10% increase in the share of the first asset type increases village incomes by almost 40%. On the other hand, a 10% rise in the share of the second mix comprising both agricultural and rural connectivity assets led to a 49% increase in the village-level income. The third stage estimates from the regression of total household consumption expenditure on asset shares are presented in column (4) of Tables 3 and 4. The results suggest that greater asset creation of both types leads to higher household consumption expenditures. A 10% increase in the assets created under the first category led to a 2.76% increase in annual per capita total household consumption expenditure. Building 10% more assets of the second type resulted in a 6.4% rise in annual per capita total consumption expenditures.

Table 5: Spillover Effects of Village-Level MGNREGS Exposure on Food and Non-Food Consumption Expenditures (Asset Category 1)

VARIABLES	(1) Food Expenditure (ln)	(2) Non-Food Expenditure (ln)
Assets created (WC, IRR, RWB, and LD)	0.00170***	0.00424***
	(0.000341)	(0.000540)
Constant	8.270***	7.867***
	(0.0155)	(0.0245)
Observations	88,635	88,635
R-squared	0.361	0.281
District FE	YES	YES

Notes to Table 5: The dependent variables of the third stage are listed at the top. The third stage regressions are at the household level. Asset category 1 comprises only agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), and land development (LD) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Spillover Effects of Village-Level MGNREGS Exposure on Food and Non-Food Consumption Expenditures (Asset Category 2)

VARIABLES	(1) Food Expenditure (ln)	(2) Non-Food Expenditure (ln)
Assets created (WC, IRR, LD, RWB, and RC)	0.00462***	0.00790***
	(0.000425)	(0.000673)
Constant	8.012***	7.431***
	(0.0297)	(0.0471)
Observations	88,635	88,635
R-squared	0.347	0.270
District FE	YES	YES

Notes to Table 6: The dependent variables of the third stage are listed at the top. The third stage regressions are at the household level. Asset category 2 comprises a combination of a) agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), land development (LD), and b) rural connectivity (RC) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Column (1) of Tables 5 and 6 depicts the third-stage regression estimates for food consumption expenditures. The findings from column (1) show that a 10% increase in the share of the first type of assets created led to a 1.7% rise in the annual per capita food consumption expenditures. On the other hand, food consumption expenditures increased by 4.62% when assets created under the second category rise by 10%. Similarly, the coefficients from column 2 of both tables show that a 10% increase in asset creation led to a 4.24% and 7.9% rise in the annual per capita non-food expenditures for the first and second categories of assets respectively. The findings from the third-stage regression suggest that asset creation leads to long-term increases in village-level incomes and household-level consumption expenditures. While households observe a rise in both food and non-food expenditures, we find that the rise in non-food expenditures is greater than that in food expenditures. Thus, there is a shift in household consumption from the food to the non-food category due to asset creation. Additionally, the two clusters of assets created under MGNREGS have heterogenous positive effects on income and consumption indicators. It is observed that higher asset creation of the second type increases village income and household consumption by a greater magnitude compared to asset creation under the first category. This indicates that building agricultural and rural connectivity assets simultaneously results in greater long-term welfare gains compared to creating only agricultural assets.

Public works related to agriculture are undertaken to improve the rural farm economy by increasing the returns from cultivation. Thus, the creation of standalone agricultural assets increase village incomes and per capita household consumption expenditures by enhancing the availability of resources required for farming. The construction of rural roads under MGNREGS enhances the connectivity of villages to nearby towns and marketplaces and facilitates the movement of goods and services. This can have a positive impact on the overall village economy. Hence, building roads simultaneously with agricultural public works leads to greater increases in village-level incomes and household consumption expenditures.

VI. Policy Implications and Conclusions

This paper identifies the channels and pathways through which MGNREGS influences welfare outcomes at the village and household levels. Using cross-sectional village and

household-level data from the nationally representative SEPRI dataset, we show that exposure to MGNREGS is the channel that increases village incomes and per capita household consumption expenditures. The duration of program exposures generates positive spillovers in the form of village-wide durable asset creation. Investing in rural infrastructure produces long-term village -wide income effects which can affect the budget constraint of individual households, and hence their consumption expenditures. Thus, we establish and highlight the significance of village-level asset creation as the pathway through which these spillovers impact income and consumption expenditures. The findings from our analysis reveal that a longer duration of village-level program exposure is associated with greater village-wide asset creation.

Next, we examine how asset building under MGNREGS and the type of assets built, affect village-wide incomes and household consumption expenditures. we consider two categories of assets for our analysis viz. a) standalone agricultural assets and b) a combination of agricultural and rural road assets. The estimation results indicate that village-wide durable asset creation under MGNREGS leads to long-term increases in village-level income and the annual per capita total household consumption expenditures. Further, we also find a rise in the annual per capita food and non-food consumption expenditures. The increase in non-food expenditures is observed to be greater than that of food expenditures. However, the impact on the village-wide and household-level welfare outcomes differs for the two asset clusters. While asset creation of both types has a positive effect on income and expenditures, the impacts of building both agricultural assets and road works are relatively greater. Thus, the findings from this paper highlight the importance of constructing a cluster of agricultural and connectivity-based assets to attain greater welfare gains.

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APPENDIX: A Comparison of OLS, 2SLS, and 3SLS Estimates

Table A1: OLS vs 2SLS vs 3SLS (Asset Category 1)

VARIABLES	(1) Duration	(2) Assets Created	(3) Duration	(4) Assets Created	(5) Duration	(6) Assets Created
	OLS	OLS	2SLS	2SLS	3SLS	3SLS
Female reservations-current panchayat (Yes=1)	2.297***	4.312***	2.297***	2.955***	2.330***	1.141***
	(0.0541)	(0.157)	(0.0541)	(0.169)	(0.0534)	(0.132)
Area irrigated by government canal (ln)	-0.363***		-0.363***		-0.452***	
	(0.0129)		(0.0129)		(0.0126)	
Bus index	1.184***		1.184***		1.185***	
	(0.0295)		(0.0295)		(0.0289)	
Duration of MGNREGS exposure		0.0494***		0.609***		1.291***
		(0.00945)		(0.0242)		(0.0231)
No of years to next panchayat election		3.478***		3.468***		1.449***
		(0.0907)		(0.0924)		(0.0698)
Constant	122.2***	-7.527***	122.2***	-75.42***	122.2***	-155.2***
	(0.176)	(1.258)	(0.176)	(2.979)	(0.176)	(2.865)
Observations	88,650	88,650	88,650	88,650	88,650	88,650
R-squared	0.901	0.728	0.901	0.717	0.901	0.673
District FE	YES	YES	YES	YES	YES	YES

Notes to Table A1: Columns (1), (3), and (5) report the results of the first-stage regression from the OLS, 2SLS, and 3SLS methods respectively. Columns (2), (4), and (6) reports the results from the second-stage regressions of the OLS, 2SLS, and 3SLS methods respectively. The dependent variables of each stage are listed at the top. The first and second stage regressions are at the village level. Asset category 1 comprises only agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), and land development (LD) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A2: OLS vs 2SLS vs 3SLS (Asset Category 1)

VARIABLES	(1) Village Income (ln)	(2) Total Consumption Expenditure (ln)	(3) Village Income (ln)	(4) Total Consumption Expenditure (ln)	(5) Village Income (ln)	(6) Total Consumption Expenditure (ln)
	OLS	OLS	2SLS	2SLS	3SLS	3SLS
Assets created (WC, IRR, RWB, and LD)	-0.00102***	0.000341***	0.0274***	0.00183***	0.0396***	0.00276***
	(0.000105)	(9.88e-05)	(0.000597)	(0.000395)	(0.000501)	(0.000394)
Electricity in the village (Yes=1)	0.462***		0.399***		1.033***	
	(0.0173)		(0.0234)		(0.0201)	
Area of the village (ln)	0.524***		0.410***		0.439***	
	(0.00315)		(0.00486)		(0.00355)	
Public financial institution within the village (Yes=1)	0.525***		0.678***		0.497***	
	(0.00629)		(0.00907)		(0.00717)	
Constant	12.25***	8.803***	12.94***	8.794***	12.19***	8.790***
	(0.0322)	(0.0177)	(0.0458)	(0.0179)	(0.0372)	(0.0179)
Observations	88,650	88,650	88,650	88,650	88,650	88,650
R-squared	0.805	0.335	0.642	0.333	0.466	0.330
District FE	YES	YES	YES	YES	YES	YES
Hausman statistic			1107.35***			
Prob>Chi2			0.000			

Notes to Table A2: Columns (1) and (2) report the results of the third-stage regression from the OLS method. Columns (3) and (4) report the results of the third-stage regression from the 2SLS method. Columns (5) and (6) report the results of the third-stage regression from the 3SLS method. The dependent variables are listed at the top. In the third stage, income and consumption regressions are at the village and household- levels respectively. Asset category 1 comprises only agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), and land development (LD) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A3: OLS vs 2SLS vs 3SLS (Asset Category 1)

VARIABLES	(1) Food Expenditure (ln)	(2) Non-Food Expenditure (ln)	(3) Food Expenditure (ln)	(4) Non-Food Expenditure (ln)	(5) Food Expenditure (ln)	(6) Non-Food Expenditure (ln)
	OLS	OLS	2SLS	2SLS	3SLS	3SLS
Assets created (WC, IRR, RWB, and LD)	0.000127	0.000364***	0.00108***	0.00277***	0.00170***	0.00424***
	(8.55e-05)	(0.000135)	(0.000341)	(0.000541)	(0.000341)	(0.000540)
Constant	8.279***	7.889***	8.272***	7.873***	8.270***	7.867***
	(0.0153)	(0.0243)	(0.0155)	(0.0246)	(0.0155)	(0.0245)
Observations	88,635	88,635	88,635	88,635	88,635	88,635
R-squared	0.364	0.288	0.363	0.286	0.361	0.281
District FE	YES	YES	YES	YES	YES	YES
Hausman statistic			1078.03***			
Prob>Chi2			0.000			

Notes to Table A3: Columns (1) and (2) report the results of the third-stage regression from the OLS method. Columns (3) and (4) report the results of the third-stage regression from the 2SLS method. Columns (5) and (6) report the results of the third-stage regression from the 3SLS method. The dependent variables are listed at the top. The third stage regressions are at the household level. Asset category 1 comprises only agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), and land development (LD) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A4: OLS vs 2SLS vs 3SLS (Asset Category 2)

VARIABLES	(1) Duration	(2) Assets Created	(3) Duration	(4) Assets Created	(5) Duration	(6) Assets Created
	OLS	OLS	2SLS	2SLS	3SLS	3SLS
Female reservations-current panchayat (Yes=1)	2.297***	5.623***	2.297***	5.665***	2.391***	3.727***
	(0.0541)	(0.122)	(0.0541)	(0.129)	(0.0539)	(0.110)
Area irrigated by government canal (ln)	-0.363***		-0.363***		-0.385***	
	(0.0129)		(0.0129)		(0.0128)	
Bus index	1.184***		1.184***		1.107***	
	(0.0295)		(0.0295)		(0.0294)	

VARIABLES	(1) Duration	(2) Assets Created	(3) Duration	(4) Assets Created	(5) Duration	(6) Assets Created
	OLS	OLS	2SLS	2SLS	3SLS	3SLS
Duration of MGNREGS exposure		0.313***		0.296***		0.453***
		(0.00735)		(0.0184)		(0.0181)
No of years to next panchayat election		-1.231***		-1.231***		-0.444***
		(0.0705)		(0.0705)		(0.0568)
Constant	122.2***	20.43***	122.2***	22.52***	122.1***	2.244
	(0.176)	(0.979)	(0.176)	(2.274)	(0.176)	(2.230)
Observations	88,650	88,650	88,650	88,650	88,650	88,650
R-squared	0.901	0.741	0.901	0.741	0.901	0.739
District FE	YES	YES	YES	YES	YES	YES

Notes to Table A4: Columns (1), (3), and (5) report the results of the first-stage regression from the OLS, 2SLS, and 3SLS methods respectively. Columns (2), (4), and (6) report results from the second-stage regressions of the OLS, 2SLS, and 3SLS methods respectively. The dependent variables of each stage are listed at the top. The first and second stage regressions are at the village level. Asset category 2 comprises a combination of a) agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), land development (LD), and b) rural connectivity (RC) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A5: OLS vs 2SLS vs 3SLS (Asset Category 2)

VARIABLES	(1) Village Income (ln)	(2) Total Consumption Expenditure (ln)	(3) Village Income (ln)	(4) Total Consumption Expenditure (ln)	(5) Village Income (ln)	(6) Total Consumption Expenditure (ln)
	OLS	OLS	2SLS	2SLS	3SLS	3SLS
Assets created (WC, IRR, RWB, LD, and RC)	0.00160***	-0.000406***	0.0305***	0.00364***	0.0488***	0.00644***
	(0.000132)	(0.000126)	(0.000584)	(0.000493)	(0.000519)	(0.000491)
Electricity in the village (Yes=1)	0.445***		0.191***		0.627***	
	(0.0173)		(0.0220)		(0.0200)	
Area of the village (ln)	0.518***		0.486***		0.489***	
	(0.00312)		(0.00392)		(0.00313)	
Public financial institution within the village (Yes=1)	0.534***		0.609***		0.513***	
	(0.00627)		(0.00792)		(0.00665)	
Constant	12.21***	8.830***	11.01***	8.587***	9.590***	8.431***
	(0.0326)	(0.0193)	(0.0467)	(0.0346)	(0.0391)	(0.0344)
Observations	88,650	88,650	88,650	88,650	88,650	88,650
R-squared	0.805	0.335	0.699	0.327	0.519	0.313
District FE	YES	YES	YES	YES	YES	YES
Hausman statistic			1184.58***			
Prob>Chi2			0.000			

Notes to Table A5: Columns (1) and (2) report the results of the third-stage regression from the OLS method. Columns (3) and (4) report the results of the third-stage regression from the 2SLS method. Columns (5) and (6) report the results of the third-stage regression from the 3SLS method. The dependent variables are listed at the top. In the third stage, income and consumption regressions are at the village and household- levels respectively. Asset category 2 comprises a combination of a) agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), land development (LD), and b) rural connectivity (RC) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A6: OLS vs 2SLS vs 3SLS (Asset Category 2)

VARIABLES	(1) Food Expenditure (ln)	(2) Non-Food Expenditure (ln)	(3) Food Expenditure (ln)	(4) Non-Food Expenditure (ln)	(5) Food Expenditure (ln)	(6) Non-Food Expenditure (ln)
	OLS	OLS	2SLS	2SLS	3SLS	3SLS
Assets created (WC, IRR, RWB, LD, and RC)	-0.000729***	-0.000236	0.00231***	0.00471***	0.00462***	0.00790***
	(0.000109)	(0.000173)	(0.000426)	(0.000675)	(0.000425)	(0.000673)
Constant	8.323***	7.905***	8.141***	7.608***	8.012***	7.431***
	(0.0167)	(0.0264)	(0.0298)	(0.0473)	(0.0297)	(0.0471)
Observations	88,635	88,635	88,635	88,635	88,635	88,635
R-squared	0.364	0.288	0.359	0.281	0.347	0.270
District FE	YES	YES	YES	YES	YES	YES
Hausman statistic			1115.91***			
Prob>Chi2			0.000			

Notes to Table A6: Columns (1) and (2) report the results of the third-stage regression from the OLS method. Columns (3) and (4) report the third-stage regression results from the 2SLS method. Columns (5) and (6) report the results of the third-stage regression from the 3SLS method. The dependent variables are listed at the top. The third stage regressions are at the household level. Asset category 2 comprises a combination of a) agricultural assets: water conservation (WC), irrigation (IRR), renovation of water bodies (RWB), land development (LD), and b) rural connectivity (RC) works. All regressions include district-fixed effects and standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1.