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Does farm level diversification improve household dietary diversity?
Evidence from Rural India

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Abstract

Using data from a nationally representative survey of farm households in India we identify a causal link between dietary-diversity and farm level diversification. Propensity score matching techniques show that households which exclusively grow cereals (our treatment-group) consume significantly less diverse diet compared to those who grow both cereals and other crop-groups (our control-group). Various matching rules have been used to check for robustness of our results.

Key words: dietary diversity, farm diversification, propensity score matching, India

1. Introduction

Malnutrition is recognized as a major issue among low-income households in developing countries (Black et al., 2008; FAO, 2010 and 2012; WFP, 2012; and IFAD, 2012). An emerging line of research has been to tackle this problem through the channel of agriculture. Among the different pathways (identified by Gillespie and Kadiyala; 2012, Hawkes and Ruel, 2008 among many others) through which agriculture and nutrition are interlinked, one of the most direct ones is as source of food. To empirically understand the link between agriculture and nutrition, in this paper we exploit the relationship between farm production diversity and dietary diversity at the household level in India. India makes for an interesting case study to explore this relationship because of (1) a significant rural population (approximately 68%[2]) (2) very poor nutrition status and (3) agriculture still remains as one of the most dominating sectors in terms of livelihood generation in the economy. Therefore a causal link between agricultural diversification and dietary diversity can potentially help in recognizing farm level diversification as a strategy to promote dietary diversity among households. Dietary diversity has been long known by nutritionists as a key element of high quality diet as it allows for the consumption of wider variety of food groups. Ruel (2002) summarizes that dietary diversity is a promising measurement tool and that existing literature confirms association between dietary diversity, dietary quality, nutrient adequacy and food security, though they recommend future research in order to operationalize it further.

Role of farm level diversification in improving dietary diversity pattern is gaining prominence over the last few years. However, conclusions from studies exploring the link between farm diversity and dietary diversity have been far from uniform. Studies like Pelleginni and Tasciotti, 2014, Jones et al, 2014, Kumar et al, 2015, Bhagowalia et al (2012) among many others have concluded in favour of

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[2] Source: http://data.worldbank.org/indicator/SP.RUR.TOTL.ZS

impact of farm diversification while others like Sibhatu et al and Rajendran et al, 2014 did not find any significant role of the same. Against this backdrop, the objective of this paper is to establish a causal relationship between the two and identify if households which are exclusively cereal growers have a different dietary pattern compared to households with more diverse production basket. Findings from this empirical exercise will substantiate evidence in favour of positive impacts of agricultural farm level diversification not only on income, reduction of poverty but improvement of nutritional status as well.

This note is organized in the following manner: In the next section, we discuss data and methodology used for the analysis, in section 3 we discuss our results and conclude in section 4.

2. Data and research methods

For the analysis, we use data from a nationally representative survey of farm households conducted by the National Sample Survey Organization (NSSO) of the Government of India in 2003 (GoI, 2005). The survey was conducted in 6638 villages spread over almost all the districts in the country (566). It contains information on social, economic, institutional, and organizational aspects of farming generated from a sample of 51,770 farmer households. To our best possible knowledge, this is the only dataset that provides information on both consumption and production related data and hence enables us to match the two for the same household[3]. Alongside, the survey provides information on several household characteristics, income source, institutional dimensions of farming such as access to credit, insurance, and extension; farmer's awareness etc.

To estimate the impact of farm level diversification on dietary diversity, we use a propensity score matching (PSM) methodology wherein our outcome variable is the log of count of number of food groups consumed by the household in the last 30 days. The food groups used for calculating the count measure are: cereal, pulses, gram, milk and milk related products, oil and oil related products eggs, fish, meat, vegetables, fruits, dry fruits, sugar, salt, spices, beverages, cooked meal and processed food. Our treatment variable is a binary indicator variable and equals '1' if households grow only cereals (treatment group) and '0' if households grow cereals and other crop groups (control group). PSM framework will help us identify if given all the observable differences among treatment and control group if dietary basket of a household would be different had he not been given the treatment (i.e. counterfactual). The main purpose of matching is to create the conditions of an experiment when actually no randomized group is available. Matching across covariates will remove the bias associated with differences in the covariates. This will allow estimating the marginal treatment effect of a growing exclusively cereals vis-à-vis growing diverse crop groups (counterfactual units), conditional on their characteristics being similar. This will correct bias arising from 'self-selection' as households

[33] Latest Situation Assessment Survey was done in 2013-14, 70th round. However, it does not provide detailed breakup of food consumption expenditure of the household.

deciding to produce a diverse range of crops might be fundamentally different from those who exclusively produce cereals and therefore, their dietary pattern might be different not because of the treatment but because of other factors.

First, the propensity score is estimated using a logistic regression model, in which treatment status (which in our case is the dummy variable for cereal taking a value of 1 when the farmer only grows cereals and 0 when the farmer produces other crops) is regressed on observed characteristics of the farmer. The estimated propensity score is therefore the predicted probability of a household producing only cereals given its characteristics. Second, a matching method is selected to be used to match treatment and control group. A number of matching methods have been suggested in the literature. Three matching methods have been used in this study: (1) nearest neighbour or one to one matching where each treatment unit is matched to the comparison unit with the closest propensity score; (2) caliper matching that impose a threshold on the propensity scores distance to overcome the problem of high propensity scores for a participant and its closest nonparticipant associated with one to one matching; and (3) the kernel-based (KM) matching method that uses a weighted average of all nonparticipants to construct the counterfactual match for each participant. A common support constraint, which is where the distributions of the propensity scores for the treatment and control group overlaps, is also imposed where the observations to be matched are dropped from the sample when their estimated propensity score is either above the maximum or below the minimum propensity score of the other group.

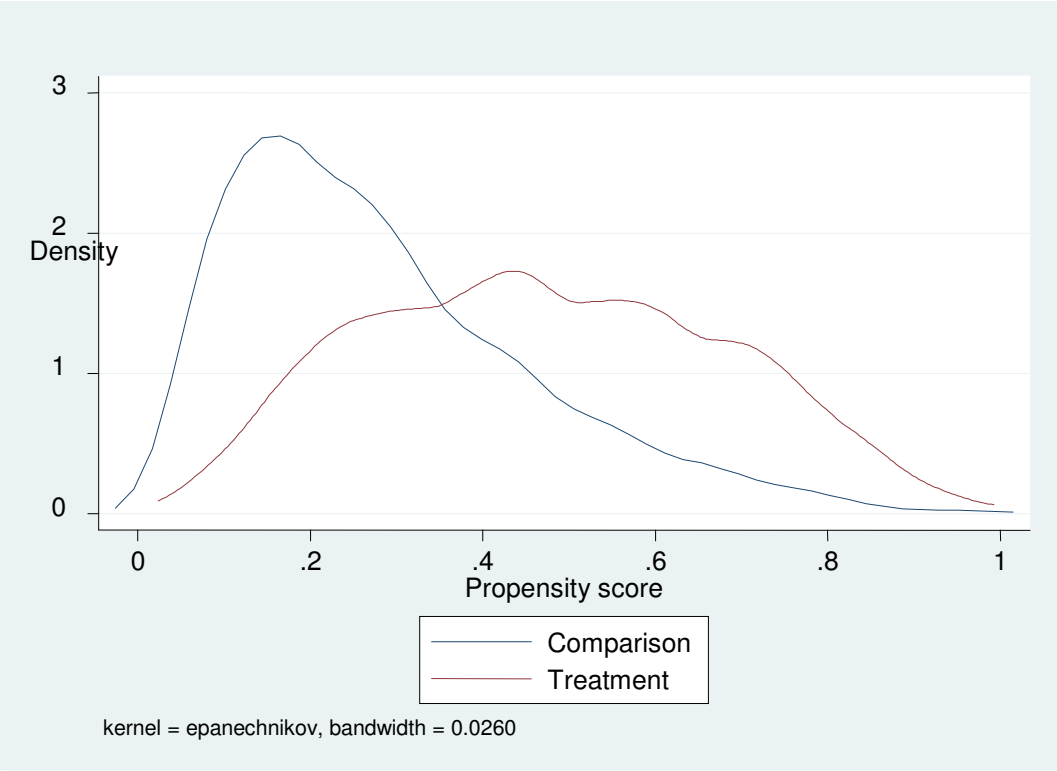
We also check to see if the mean of all the covariates variables are statistically the same between the matched treated and control groups. Mean absolute standardized bias (MASB) between adopters and non-adopters has been used for this check. Estimators are regarded as balanced when there is absolute reduction in the MASB between the matched and the unmatched models. The treatment effects are estimated if the equality of means of any variables between the two groups is not significantly different from each other. However, if the equality of means test is rejected, the propensity score is re-estimated using a different set of conditional variables until a proper set of covariates is found.

3. Results

Figures 1 and 2 show the propensity score distribution for the treated and untreated groups and region of common support respectively. Both these indicate that there is overlap in the distributions of the propensity score. Table 1 gives the results for covariate balance tests for unmatched sample and those matched using our three matching rules. We find that after matching difference in means for each of the covariates are not statistically different from each other between the two groups. Further, the relatively low pseudo- R square and the p-values of the likelihood ratio test of joint significance of

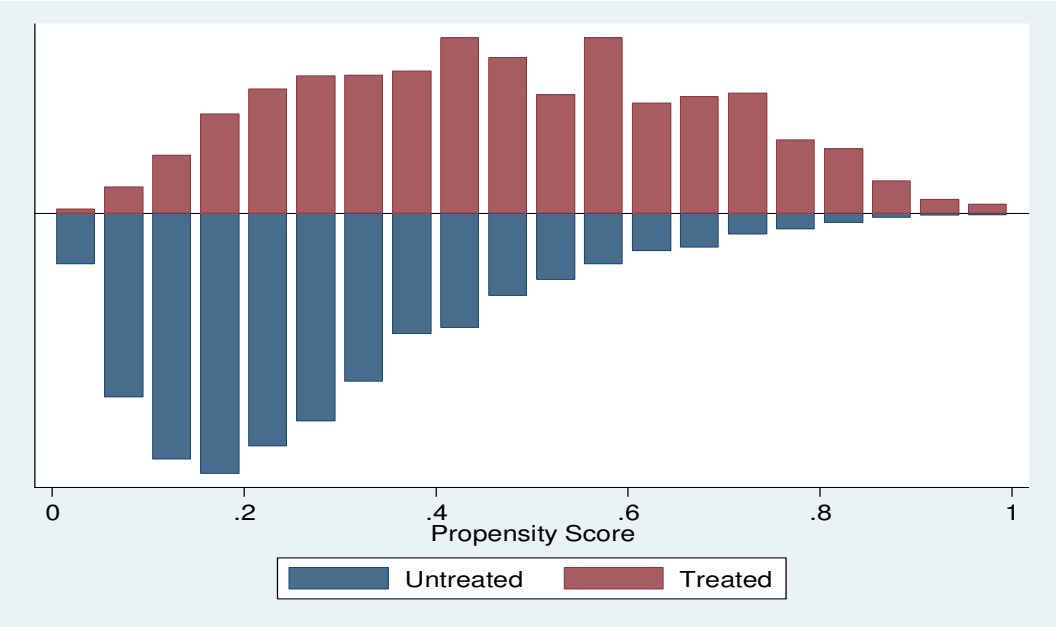
regressors (last row of Table 2) confirm that, after matching, there are no systematic differences in the distribution of covariates between the two groups.

Figure 1: Propensity score distribution for the treatment and comparison group



Source: Author's computation

Figure 2: Common support region



Source: Author's computation

Table 1: Balance of covariates

	Unmatched			Nearest neighbour matching			Calliper based matching			Kernel based matching		
Variables	Treated	control	p-value	treated	control	p-value	treated	control	p-value	treated	control	p-value
Ln cultivated land	-0.44509	0.64328	0.00	-0.44509	-0.44919	0.872	-0.3607	-0.36433	0.88	-0.44509	-0.42841	0.51
Participate in training	0.0215	0.03117	0.002	0.0215	0.02028	0.699	0.02127	0.01924	0.523	0.0215	0.02258	0.74
Participate in village fairs	0.03445	0.03563	0.742	0.03445	0.03714	0.513	0.03367	0.03392	0.95	0.03445	0.0386	0.317
Members of NGOs	0.01246	0.01257	0.958	0.01246	0.01417	0.5	0.01241	0.01316	0.764	0.01246	0.01473	0.375
Taken loan from credit agencies	0.02248	0.03183	0.004	0.02248	0.02663	0.225	0.02278	0.02684	0.247	0.02248	0.02454	0.538
Aware of procurement agencies	0.56462	0.63301	0.00	0.56462	0.55241	0.266	0.56937	0.55139	0.108	0.56462	0.55976	0.657
Dependency ratio	0.34881	0.35869	0.025	0.34881	0.35532	0.21	0.35079	0.35331	0.632	0.34881	0.35083	0.696
Share of land owned	1.2	1.0186	0.092	1.2	1.1461	0.716	1.2065	1.1177	0.554	1.2	1.1671	0.829
Monthly expenditure	17.702	34.669	0.062	17.702	18.031	0.475	17.949	18.256	0.52	17.702	18.374	0.657
Share of members not literate	0.2215	0.19968	0.00	0.2215	0.22172	0.955	0.22063	0.22266	0.61	0.2215	0.21545	0.121
Aware of min. supp. Price	0.92108	0.94172	0.00	0.92108	0.91937	0.775	0.92354	0.91975	0.53	0.92108	0.92071	0.95
Pseudo-R square	0.154		0.000	0.001		0.860	0.001		0.853	0.000		0.896

Source: author's computation

We present the results of treatment effects viz. the Average Treatment on Treated (ATT) in Table 2. Estimates of ATT for all the matching techniques indicate that dietary diversity for only cereal growers is significantly less than that of those farmers who produce other crops. Our treatment group viz. only cereal growers have an approximately 1.7 percentage points lower dietary diversity compared to that of those who produce other crop groups as well (control group). The results match for all the matching techniques further adding robustness to our results.

Table 2: Average treatment effects

	Matching versions	ATT	t-stat
1.	Nearest neighbour matching	-0.017	-4.64
2.	Caliper matching	-0.016	-4.41
3.	Kernel matching	-0.01	-5.48

Source: Author's computation

4. Conclusion

Studies like Bhagowalia et al (2012), Gillespie et al (2012) etc. have discussed possible linkages between agriculture and nutrition. One of those identified channels is linkage between agricultural diversification and dietary diversity. In this paper, we provide empirical evidence in favour of causal relationship between agricultural diversification and dietary diversity. Our results show that after controlling for possible other factors, only cereal growers have a significantly lower dietary diversity compared to those farmer households who produce other high value crops. Robustness checks corroborate our findings. This paper contributes to the relatively scant literature on the causal linkages between agriculture and nutrition. Our results show that in addition to existing positive impacts of farm level diversification, it also plays a significant role on the food platter of households wherein farm households who have a more diversified production basket also consume a more diversified platter. With the evidence presented in this paper, farm diversification can be seen to be a potential strategy to improve the dietary behaviour and therefore the nutrition status of households

References

Bhagowalia, P., Headey, D., &Kadiyala, S. (2012). Agriculture, income, and nutrition linkages in India: Insights from a nationally representative survey. *International Food Policy Research Institute. Washington, DC*

Gillespie, S., Harris, J., &Kadiyala, S. (2012). The agriculture-nutrition disconnect in India: What do we know. *Washington, DC: International Food Policy Research Institute*.

Gulati, A., Ganesh-Kumar, A., Shreedhar, G., &Nandakumar, T. (2012).Agriculture and malnutrition in India. *Food & Nutrition Bulletin*, *33*(1), 74-86.

Hawkes, C., & Ruel, M. T. (2008). From Agriculture to Nutrition: Pathways, Synergies and Outcomes.

Jones, A. D., Shrinivas, A., &Bezner-Kerr, R. (2014). Farm production diversity is associated with greater household dietary diversity in Malawi: Findings from nationally representative data. *Food Policy*, *46*, 1-12.

Kumar, N., Harris, J., &Rawat, R. (2015). If They Grow It, Will They Eat and Grow? Evidence from Zambia on Agricultural Diversity and Child Undernutrition.*The Journal of Development Studies*.

Pellegrini, L., &Tasciotti, L. (2014). Crop diversification, dietary diversity and agricultural income: empirical evidence from eight developing countries.*Canadian Journal of Development Studies/Revue canadienned'études du développement*, *35*(2), 211-227.

Rajendran, S., Afari-Sefa, V., Bekunda, M., Dominick, I., &Lukumay, P. J. (2014, April). Does crop diversity contribute to dietary diversity? Evidence from integration of vegetables into maize based farming systems in Tanzania. In*88th Annual Conference, April 9-11, 2014, AgroParisTech, Paris, France* (No. 170542). Agricultural Economics Society.

Ruel, M. T. (2003). Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs. *Food Nutr Bull*,*24*(2), 231-2.