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Links between Diversification of Family Income and Returns from Agriculture in Rural Odisha

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ABSTRACT

With the manifestations of rapid rural transformation in Odisha, the households have also started diversifying their sources of income. At the same time, with the spread of neo-liberal ethos and abundance of knowledge on commodities, the consumption pattern has also registered a significant change. The analysis of household-level consumption expenditure data released through NSSO rounds also reflects such changes happening across the country. It is in this context that the paper seeks to explore the composition of household income in selected rural conglomerations in Odisha. As a step forward, the paper also tries to examine the role of diversification of family income in influencing the returns from agricultural occupations. The study uses the Simpson Index as a proxy for occupational diversification. With the help of descriptive and inferential statistical tools on primary data collected from 1500 sample rural households in nine selected districts, we conclude that families with greater occupational diversity also have better returns from agricultural activities through the process of rural transformation. This study confirms that households with less diversified occupations have lesser total income, total value of assets and agricultural land than that of the households with diversified occupations. Labour productivity is also found to be higher for the later than the former. The key differences in average outcomes for both groups have been established through Mann-Whitney U test. The researcher draws that, policies with a focus on creating diversified livelihoods options are more likely to have better outcomes for the agricultural sector than policies that focus on agriculture alone.

Keywords: Returns from agriculture, Family income, Rural transformation, Occupational diversification

JEL Classification Codes: Q12, Q19, D10, R29

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I. INTRODUCTION

Agriculture and allied activities have a distinction of being the largest employer in the Indian economy, albeit, at a subsistence level. As per the 2011 census report, almost 69 percent of the country's populations were living in the rural areas compared to around 84 percent in Odisha. It seems Odisha is less urbanized vis-à-vis the country. The rural-urban classification in our country is based on the predominance of agricultural and non-agricultural occupations. Therefore, it can be presumably argued that the economy of Odisha is relatively more dependent on agriculture than the country. However, the finding of the recent labour force participation survey 2018-19 provides a surprising different picture. As per the 2018-19 study of PLFS by NSSO around 48.3 percent of all rural households in India are still defined as agricultural households indicating predominant involvement of family members in the sector. Of these, around three-fourth are farmer cultivators and one-fourth are agricultural workers. In Odisha, less than 40 percent of the rural households can be considered agricultural families of which only around 5.6 percent are agricultural workers (MoSPI 2019). This shows that why a relatively higher proportion of Odisha's population still live in rural areas, their primary occupation is more diversified compared to the national scenario. Among the usually working persons classified as per NIC 2008 in rural areas, around 58 percent in India are in agricultural sector compared to a much lesser share of population (50 percent).Table-1 shows the sectoral composition of occupation in Odisha vis-à-vis India. As we may notice, the proportion of male as well as female workers engaged in agriculture, forestry and fishing was lower compared to the national situation. This, however, does not mean that workers in Odisha have adopted occupations in better paying non-agricultural activities but the situation may hint at a rather gloomy picture of distress in Odisha's rural economy as we may notice from Table-1 the share of workers engaged in manufacturing and many other activities are also less compared to the national scenario. It seems that workers in Odisha did not leave agricultural sector because of their aspirations for other better paying occupations but were forced to work in other sectors due to low returns from agriculture. The sectors that absorbed more number of workers in Odisha compared to India are typically those sectors that require lesser skill and the employment is very casual in nature. For example compared to around 13 percent of all workers engaged in the construction sector in India more than 21 percent have registered their occupational association with the sector in Odisha. Similarly in sectors like mining, trading, transportation and storage, etc. the relative participation of workers in Odisha is higher compared to India. At the outset, it is believed that most of these engagement are low paying and stressful in nature. Probably the process of rural transformation in Odisha is not as glorious as it is claimed by the policy makers and popular media in the state. A recent report by SDRC reveals that Odisha's agricultural workers are one of the lowest wage earners in the country (SDRC, 2020). The NSSO findings also reveal another interesting fact about agriculture in Odisha. In the year 2011, the proportion of rural households engaged as farmer cultivators and agricultural workers in India were 34.3 percent and 21 percent respectively compared to 35 percent and 17.8 percent respectively for Odisha (NSSO report 554- 31st Jan 2014). By 2018, the corresponding figures were 36.6 percent and 11.7 percent respectively for India and 34.3 percent and 5.6 percent respectively for Odisha. It seems that in

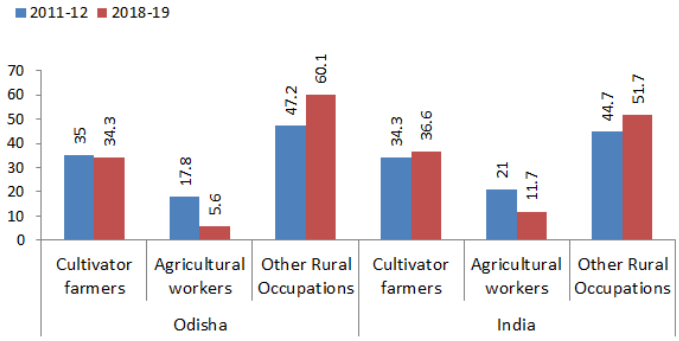
India, there was a reduction in the proportion of households engaged as agricultural workers by 9.3 percentage points where as the proportion of households engaged as cultivator farmers in the country actually increased by 2.3 percentage point. On the other hand in Odisha, the share of households engaged as agricultural workers as well as cultivator farmers declined by 12.2 and 0.7 percentage points respectively. While in India the self-employment in agriculture seems to have gained some attraction in the last decade, in Odisha the agricultural households have actually preferred other occupations and left the sector (Figure 2).

Table-1: Sectoral Composition of Occupation in India and Odisha during 2018-19

Items	Rural Male		Rural Female		Rural Persons (Male + Female)	
	Odisha	India	Odisha	India	Odisha	India
Agriculture, forestry and fishing	46.77	53.2	60.37	71.06	50.19	57.84
Mining and quarrying	0.79	0.42	0.77	0.22	0.79	0.37
Manufacturing	6.37	7.34	8.71	8.96	6.96	7.76
Electricity, gas, steam and air conditioning supply	0.12	0.23	0	0.05	0.09	0.18
Water supply; sewerage, waste management	0.17	0.18	0	0.1	0.12	0.16
Construction	23.35	15.42	14.63	5.98	21.16	12.97
Wholesale and retail trade; repair of motor vehicles	9.36	8.51	4.95	3.54	8.25	7.22
Transportation and storage	5.47	5.2	0.14	0.1	4.13	3.87
Accommodation and Food service activities	1.18	1.28	1.22	0.8	1.19	1.16
Information and communication	0.12	0.22	0.12	0.08	0.12	0.18
Financial and insurance activities	0.38	0.52	0.06	0.2	0.3	0.43
Real estate activities	0	0.08	0	0	0	0.06
Professional, scientific and technical activities	0.42	0.38	0	0.08	0.31	0.3
Administrative and support service activities	0.48	0.66	0.17	0.18	0.4	0.54
Public administration and defence; social security	0.52	1.19	0.65	0.74	0.55	1.07
Education	2.04	2.37	6.53	4.9	3.16	3.03
Human health and social work activities	0.5	0.49	1.29	1.36	0.7	0.71
Arts, entertainment and recreation	0.12	0.22	0	0.04	0.09	0.17
Other service activities	1.59	1.75	0.34	0.81	1.28	1.5
Producing activities of households for own use,	0.26	0.36	0.05	0.79	0.21	0.47
Total	100	100	100	100	100	100

Source: Periodic Labour Force Supply 2020

Figure-1: Change in the Proportion of Households Engaged in Agriculture and other Occupations in Odisha and India during 2011 and 2018



Source: Drawn by authors from the data of NSSO report 554 (2011-12) and PLFS 2020

It is further interesting to note that there seems to be a direct relationship between returns from agriculture and share of non-farm income. As can be seen from Table-2 the lower MPCE classes with lower of share of non-farm non-wage activities also have lower share of receipts from agriculture. Although the pattern seems to be stronger in Odisha compared to India, it is difficult from the available secondary information (NSSO, 2012-13) to ascertain that families with higher income from non-agricultural activities have higher agricultural productivity.

Table-2: MPCE Class Wise Share of Receipts from Agriculture and Non-Agricultural Activities

MPCE Decile Class	Income from Non Wage-Non Farm Business in Odisha	Net Receipts from Agriculture in Odisha	Monthly Income of Farmer Households in Odisha	Income from Non Wage-Non Farm Business in India	Net Receipts from Agriculture in India	Monthly Income of Farmer Households in India
MPCE-1	2.3	57.2	5246.1	3.4	52	3870
MPCE-2	1.4	68.7	3597.6	3.3	58.7	4263
MPCE-3	9.8	64.1	4629.7	7.6	55.9	4697
MPCE-4	4.2	58.3	4396.2	5.5	58.8	4739
MPCE-5	13.2	53.3	4764.3	6.2	56.6	5471
MPCE-6	3.1	65.7	5547.1	5.3	59.6	5830
MPCE-7	12.8	54.4	5538	8.5	62.1	5703
MPCE-8	4.6	76.5	6317.4	8.6	61.7	6122
MPCE-9	15.3	64.1	6139.7	7.3	60	7430
MPCE-10	15.9	62.5	8471	11.8	62	12458
All Classes	9.4	63.1	5583.2	8	59.8	6426

Source: NSS Report No.576: Income, Expenditure, Productive Assets and Indebtedness of Agricultural Households in India, 2012-13

It is in this context that one needs to understand the nature of rural transformation in the state. The moot question here is; why the rural population has not declined in the state vis-à-vis the country and there has been an increase in the number of families depending on agriculture in India, why the farmer cultivators in the state are losing hope on agricultural sector. In this paper an attempt is made to explore the answers for this question by analyzing the links between returns from agriculture and diversification of household income in the state. In the subsequent section we have discussed the data, methods and the key findings of our analysis based on primary data collected from nine different districts of Odisha. However,

before doing so a review of relevant literature that seems pertinent is presented below.

II. REVIEW OF LITERATURE

In the Indian context, agriculture sector is the main source of income for most of the agricultural families while non-farm income is a significant component for the households who are relatively richer. In states with low income low diversification, farmers at subsistence level are less diversified. Regions which are at greater production risk, diversification is more prevalent (Vatta, Singh, Sharma, & Bhoi, 2018). Looking into climate variability and rainfall shocks, households diversify their occupation to wage job and internal migration. Climatic condition plays an important role in determining total income of households and it is more pronounced while considering agricultural income. Diversification helps people to adapt the climate variability. In high rainfall shocks places, households are less responsive to diversification of income sources. It also stated that, there is no significant reduction in agricultural income when farmers have larger land but in case of small holding farmers, the reduction is significant (Chuang, 2019). Farm income has a positive relation with overall diversification level in farm but has a negative relation with diversification level only in agriculture sector (excluding horticulture sector). Diversification to horticulture, piggery, goat farming, and poultry has a positive impact on farm income. Also stated that, crop husbandry is not the only source of income for marginal farmers. The cropping intensity index, irrigation, use of HYV seeds has a positive relation with the farm income (Sen, Venkatesh, Jha, Singh, & A., 2017). There are three major sources of income such as, cultivation of crops, income from non-farm sector and animal husbandry. Diversification has a positive relation with the farm income. Younger generation, education levels of individual, OBC households, marginal farmers and family size has a positive relation with the farm income. Farmers using ICT have more diversified income sources (Khan, Tabassum, & Ansari, 2017).

In Odisha, crop diversification has increased over the years among the households. Farmers have diversified their cultivation from paddy to brinjal, ladies finger, tomato, sugarcane, beans etc. Farm income and crop diversification are positively related (Tripathy & Das, 2020). From all the districts of Odisha, Kandhamal is highly diversified and Bargarh is the least diversified. Credit, per capita income from agriculture, tractors/power tillers has a positive significant relation with the crop diversification index (Kumar, 2020). In case of highly diversified districts, returns from cultivation is higher than that of the moderately and least diversified districts. Irrigated land is used for the paddy crop and hence households with more of irrigated land are less diversified. Scheduled caste households are less diversified among all the social groups and education level promotes crop concentration (Basantaray & Nancharaiah, 2017). There is a significant difference between the income of pre and post occupation diversification of families. Also found in some studies that education plays an important role in the diversification of occupation. Declining returns in agriculture sector, seasonal unemployment and higher level of education impacted the diversification from agriculture sector to other sectors (Dalabehera & Badatya, 2020).

In the international context from a study, more than half of the households diversified their income source. It also stated that, younger generations are more engaged in diversification of income. Farmers with small size of farm land are more

involved in diversification. Households with higher livestock lead to less diversification of income. Also female headed households are less likely to diversify their source of income. Farm size and education level of the farmers have indirect and direct relationship with the diversification of income respectively (Gecho, 2017).When the farmers are associated with farmers' association, income is higher as compared to non-members. Farmers' income varies randomly with the regions. Education of farmers having a positive impact on farmers' income up to a threshold level after which its starts declining because people with higher education tries to find non-farm occupation and migrate to the cities. Non-farm income has also a positive impact on agricultural income. Smallholders' female headed households are negatively related to the farmers' income (Harrera, et al., 2018). A significant regional difference is observed in composition of households' income in terms of diversification. Migration has a positive significant relation with the diversification strategy (Alobo & Bignebat, 2017).

In case of allied activities, for small-scale fisheries and aqua-culturists, income and livelihood diversification acts as an important strategy to response the traps dynamic. Income diversification leads to increase in well-being of households in the selected category. However, it does not overcome the traps due to externalities like pollution; flood etc. (Hanh & Boonstra, 2018).

From a study in Pakistan, distribution of asset was skewed as compared to income. Half of the total income was owned by lower 83% of the sample households. Inequality in income arises mainly because of skewed distribution of assets. Households are better off when they have both source of income than the single source of income. Level of education has a positive significant relationship with the households' income. Only farm income and only non-farm income have negatively impacted the total income (Akram, Naz, & Ali, 2011). While a study in Bangladesh stated that farm income has a negative effect on non-farm income and vice-versa (Pravin & Akteruzzaman, 2012). When we consider health expenditure in relation with the income level, there is a small degree of relationship between the nutritional outcomes and change in income levels. But when income generated by self-employment increases, it positively affects the nutritional outcomes more than others. It also stated that, agricultural income seems to be more nutrition-negative than others which might be due to low-nutrient crop production (Kirk, Kilic, & Calogero, 2018).

III. METHODOLOGY

Primary data collected from 1500 rural households selected randomly from nine representative villages from nine different districts. Stratified random sampling technique was used to identify the sample respondents from two broad groups of farmers; one, the households exclusively dependent on agriculture and two, households having diverse sources of income including agriculture.A total 795 households in our sample depended on agriculture as their primary source of income of which 214 households had agriculture as their exclusive occupation and 581 households had both agricultural and other sources of income. In order to have some deeper insights we have also collected information from 703 households (control) having occupations in non-agricultural sector as their sole source of

income.Descriptive statistics, multiple regression analysis, logistic regression analysis and Mann-Whitney U test have used to analyze the data.

The study aimed at analyzing the differences in income from agriculture from both the sample groups and sought to identify the links between variables representing occupational diversification and income from agriculture. For this several models as described below were employed.

Model 1: Multiple Regression Analysis

$$PCI_i = \alpha_1 + \alpha_2 X_{1i} + \alpha_{3X_{2i}} + \alpha_4 X_{3i} + \alpha_5 X_{4i} + \alpha_6 X_{5i} + \alpha_7 X_{6i} + \alpha_8 X_{7i} + \alpha_9 D_{1i} + U_i \quad \ldots\ldots\ldots (1)$$

PCI_i = log of agricultural income per member involved in agriculture, X_{1i}= log of non-agricultural income per working member, X_{2i}= Number of family member, X_{3i}= Irrigated land in acre, X_{4i}= Non-irrigated land in acre, X_{5i}= Average years of schooling, X_{6i}= log of cost incurred in agricultural activities in last season, X_{7i}= log of value of total assets owned, D_{1i}= 1, if the household have accessed any type of loan, 0, otherwise, Ui= Error term, α_1 is intercept andα_2..... α_9 are slope coefficients of independent variables

Model 2: Simple Regression Analysis

$$AgrInc_i = \theta_1 SID_i + U_i \quad \ldots\ldots\ldots (2)$$

$AgrInc_i$= Monthly agricultural income of household, SID_i= Value of Simpson index of diversification ofhouseholdU_i= Error term, θ_1= Slope coefficient of SID

Model 3: Logistic Regression Analysis

$$L_i = \gamma_1 + \gamma_2 X_{1i} + \gamma_3 X_{2i} + \gamma_4 X_{3i} + \gamma_5 X_{4i} + \gamma_6 X_{5i} + \gamma_7 X_{6i} + \gamma_8 D_{1i} + \gamma_9 D_{2i} + \gamma_{10} D_{3i} + \gamma_{11} D_{4i} + \gamma_{12} D_{5i} + \gamma_{13} D_{6i} + \gamma_{14} D_{7i} + \gamma_{15} D_{8i} + \gamma_{16} D_{9i} + \gamma_{17} D_{10i} + \gamma_{18} D_{11i} + U_i \quad \ldots\ldots\ldots (3)$$

Li= Binary dependent variable where 1= SID value greater than mean value of SID and 0 = SID value less than mean value of SID, X_{1i} = Number of family members, X_{2i} = Total income of, X_{3i} = Age of the head of the household,X_{4i}= Agricultural land (In acre),X_{5i} = Value of total assets,X_{6i} = Average years of schooling of the household,

Dummy variables are D_{1i}as the possession of any livestock, D_{2i}= having children in school below 14years of age, D_{3i} = loan accessed, D_{4i} = involved in agriculture, D_{5i} = household belongs to OBC category, D_{6i} = household belongs to SC category, D_{7i} = household belongs to ST category, D_{8i} = household belongs to APL category, D_{9i} = household have pakka house, D_{10i} = household has the ownership of their residence, D_{11i} = household have electricity connection and U_i= Error term

i = 1, 2.....795 are the sample households with agriculture either as sole occupation or one of the occupations followed

In order to study the links between level of diversification and returns from agriculture we have used Simpson index as independent variable and agricultural income as the dependent variable in equation (2) To study the factors affecting decision for occupational diversification we have employed a logistic regression analysis with Simpson index recoded with binary values (1 for more than mean diversification index and 0 otherwise) as dependent variable and several socio-economic factors identified from literature survey as independent variables in equation (3)Simpson index for measuring the level of occupational diversification of households is computed as:

$SID=1-\Sigma P_i^2$

Where,
i = 1, 2..... n (n is the number of income sources of the household)
p_i= proportion of income from ith sources in the total income of household
$0 \leq SID \leq 1$
0- Complete specialization
1- Complete diversification

The key results of our analysis are summarised in the following section.

IV. ANALYSIS AND FINDINGS

Model 1

Analysis of the relationship depicted in model 1 shows significant F value (27.7). The results of multiple regression analysis for model 1 presented in Table-3 highlight some interesting observations. We found no significant relationship between agricultural income proxied by the log value of agricultural income per member of the household involved in agriculture and the quantity of non-irrigated land substantiating the fact that agricultural practice in our sample area depends heavily on irrigation facilities and even if a family has non-irrigated land under possession, they largely remain unutilized. At the same time we have found a significant and negative relationship between value of asset and agricultural income. In a place like Odisha, where the state of agriculture is quickly evolving due to spread of information, rapid demand changes, facilitating extension services etc., the productive asset owned by the households is probably becoming more and more useless over last few decades. The farmers in the countryside are largely becoming dependent on the capital owned by the renters. One can see many traditional agricultural assets like bullock carts, country-ploughs, traditional storage systems etc. remaining idle in household courtyards. Therefore, although, many of these assets still count as family wealth they do not contribute to the farm productivity. Rather an accumulation of these assets would only result in the diversion of resources that could have been used for borrowing modern capital and machinery for use in contemporary agricultural practices. Those with abundance of traditional agricultural assets still try to make use of those assets that result in relatively lower productivity than their peers who hire and use more productive modern machineries and equipments. This may be a possible explanation for the negative relationship between the value of total assets and agricultural income of the household in our study area.

Table-3: Coefficients Table for Model 1

Dependent Variable	Income from Agriculture	R squared (Adj)	0.271
Degree of freedom	566	F value (sig.)	27.66 (0.000)
Regressors	Beta value	t value	Significance
Constant	2.487	11.47	0.00
Log of non-agricultural income per working member	0.267	8.776	0.00
Number of family members	0.031	3.673	0.00
Irrigated land	0.057	4.362	0.00
Non irrigated land	0.005	0.663	0.508
Average years of schooling	0.003	3.187	0.002
Log of cost incurred in agriculture in last season	0.111	2.513	0.012
Log of value of total assets owned by household	-0.092	-3.707	0.00
Dummy (Loan Access)	0.068	2.472	0.014

Source: Author's calculation from primary data

We have also found no significant relationship (at 99 percent confidence interval) between access to credit facilities and income from agriculture. This is probably because the borrowings made by our sample respondent households are not used for agricultural purpose per se. Similarly there is no significant relationship between cost incurred on agriculture in the previous session and the current agricultural income (at 99 percent confidence interval). This is an interesting finding for two reasons. One, the cropping pattern is diverse and decision regarding a particular crop/ agricultural activities is not taken on the basis of cost experiences, but because of prevailing market conditions and future expectations. Two, during our field visit we observed active participation of agricultural extension service officials in the study area, their involvement might have influenced the crop decision of the farmers irrespective of the cost structure in the previous agricultural cycle. Apart from these three variables, for others we found significant relationship between dependent and independent variables. Several other factors such as family size, quantity of irrigated land under occupation, level of education etc. also have significant positive relationship with the agricultural income. Among these the amount of non-agricultural income has positive and significant relation with highest beta value 0.27. We therefore reject the null hypothesis and conclude that possibly it is the size of the non-agricultural income accrued by the household that explains the majority of the variations of agricultural income. The descriptive statistics of primary data also shows similar results as described in Table-4.

Table-4: Average Income of all Categories of Households

Category	**Average Income**	**Agricultural Income**	**Observations**
Only Agriculture	7112.46	7112.46	214
Agriculture & Non-Agriculture	21639.13	7401	581
Only Non-Agriculture	20789	0	703
All Households	19180	NA	1498

Source: Author's calculation from primary data

Table-4 confirms that, when the household have diversified sources of income (i.e. both agricultural as well as non-agricultural income) returns from agriculture sector is better. When the households have agriculture as the only source of income, their average monthly income is 7112.46 but in case of households having both sources of income, average monthly income received from agriculture sector increases to 7401/- and households' total income to 21639.13 while income of households with only non-agricultural source is 20789.

Model 2

From the regression result of model 2, we can say that there exists a positive and significant relationship between the agricultural income and the diversification index of households. As the sources of income from different occupations of household members' increases, their agricultural income also increases. This is probably because of the financial support from family members' income (other than agricultural sector) for investment in agriculture which in turn increases the agricultural income.

Table-5: Coefficients Table for Model 2

Dependent Variable	**Agricultural Income of Household**	**R squared (Adj)**	**0.522**
Degree of freedom	580	F value (sig.)	636.55 (0.000)
Regressors	Beta Value	t value	Significance
Simpson Index	0.723	25.23	0

Source: Author's calculation from primary data

Model 3

We have undertaken a logistic regression model to identify the factors affecting the diversification decision of households of the sample area where we have taken several continuous as well as dummy variables as independent variables. Out of six continuous variables, two are insignificant and four significantly impacted the dependent variable (three at 99 percent confidence interval and one at 95 percent). Number of family members has a significant impact on the diversification decision. As the number of family member increases, occupational diversification also increases. Age of head of the household has a positive and significant impact on the diversification decision, as in the rural areas, decision of the households are mostly taken by the head of the households and with increase in their age, they gain better experience about the occupational scenario. Similarly, agricultural land under occupation also positively affects the diversification decision; this is because, as land under occupation increases, their scope for crop diversification also increases.

In this model, we have taken eleven dummy variables, out of which five are significant and rests are insignificant. Possession of livestock has a positive and significant relationship with the diversification decision of the household. This is because, in rural areas, possession of livestock is treated as secondary income source hence, degree of diversification increases. There is a negative on the diversification index when the household have children below 14 years of age. The negative relationship can be explained in such a way that, when the household

have kids they spend time with their kids rather focusing on other income sources. As mentioned earlier in model 1, access to credit facility is insignificant in this model too. Households belongs to the social category ST have more diversified income than others as there are certain castes who follow their traditional occupation along with other occupations, hence the degree of diversification increases. When the household lies above the poverty line, it has a negative impact on the diversification index. In other words, household below the poverty line have more diversified income but this situation does not mean that they have adopted better paying non-agricultural occupation rather they are forced to diversify for their livelihoods.

Table-6: Coefficients Table of Model 3

Dependent Variable-	**Logit, 1 for Highly Diversified and 0 for Less Diversified**	**R Squared**	**36.7**
Regressors	Beta value	Odds ratio	Significance
Constant	-2.112	0.121	0.008
Number of family members	0.481	1.618	0
Total income	0	1	0
Age of head of household	0.023	1.023	0
Agricultural land in acre	0.087	1.09	0.024
Value of total asset	0	1	0.1
Average years of schooling	0.01	1.01	0.185
Dummy possession of livestock	0.427	1.533	0.001
Dummy children in school	-0.517	0.596	0
Dummy loan access	0.16	1.174	0.24
Dummy involved in agriculture	0.713	2.039	0
OBC dummy	-0.237	0.789	0.131
SC dummy	0.271	1.311	0.143
ST dummy	1.039	2.825	0.001
Dummy economic category	-0.866	0.421	0
Dummy housing structure	-0.15	0.861	0.285
Dummy ownership of residence	-1.234	0.291	0.051
Dummy electricity	-0.449	0.638	0.24

Source: Author's calculation from primary data

Table-7: Mean Table

Variables	Only Agriculture	Agriculture and Non-Agriculture
Total income	7112.46	21463.58
Agricultural land in acre	2.16	2.51
Irrigated land in acre	0.966	1.05
Non-irrigated land in acre	1.11	1.31
Total asset	318829.9	534281.9
Productive asset	184757	236455.4
Amount of loan borrowed	13495.33	21506.03
Amount of loan outstanding	6585.05	8920.3
Amount of loan repaid	7260.75	10456.98
Average years of schooling	11.41	12.73
Cost incurred in agriculture	14357.94	17385.54
Revenue earned from agriculture	29220.32	40680.34
Profit from agriculture	14862.38	23244.8

Source: Author's calculation from primary data

Averages of all the relevant variables of households having only agriculture and both agriculture & non-agriculture sector as their source of income are presented in the table (Table-7). Mann-Whitney U test was used to identify the key differences in average outcomes for both the groups.

Mann-Whitney U Test

Here we have performed Mann-Whitney U test to check the difference between the mean scores of variables of both groups. As the population is not normal, we have applied non parametric Mann-Whitney U test instead of using independent samples t test. Here the null hypothesis is,

H_0: The distribution of variables is same across the categories

For variables like agricultural income, agricultural land, irrigated land, non-irrigated land and productive asset we accept the null hypothesis that the distributions of these variables are same across the categories (i.e. households with agriculture as only source of income and households having diversified sources of income) and for variables like total income, total asset, others asset, amount of loan borrowed, amount of loan outstanding, amount of loan repaid, average years of schooling, cost incurred in agriculture, revenue earned from agriculture and profits earned from agriculture null hypothesis is rejected as these variables are statistically significant which implies that the distribution of variables are not same across the categories.

Table-8: Independent Samples Mann- Whitney U Test

Variables	Significance
Agricultural Income	0.053
Total Income	0
Agricultural land in acre	0.668
Irrigated land in acre	0.573
Non-irrigated land in acre	0.821
Total asset	0
Productive asset	0.113
Others asset	0
Amount of loan borrowed	0
Amount of loan outstanding	0
Amount of loan repaid	0
Average years of schooling	0
Cost incurred in agriculture	0
Revenue earned from agriculture	0
Profit from agriculture	0

Source: Author's calculation from primary data

V. CONCLUSION

In case of rural Odisha when we consider the two groups; one with only agricultural income and other with both agricultural and non-agricultural income, we find that for the latter the total income, land holdings, total assets are higher.

While the agricultural income is not significantly different between the two groups, total income, asset, agricultural land is significantly higher for households having sources of income other than agriculture. Households with agriculture as only source of income face higher cost-revenue ratio than households having both sources and hence lowering profits, thus diversification helps improve returns from agriculture. Diversification of income sources has been found to be useful for households by increasing returns, improving loan repayment capacity and better asset holding.

To conclude, as the transformation goes up in the rural area, people transformed their skill, techniques of production and also act upon the diversification of occupation. There are many factors which have an impact on the agricultural income of the family. Higher education of the family members led to the development of the quality of inputs which in turns provides better income to the family. Likewise, family members employed in other sectors helps financially to reduce the liabilities and to invest more on agriculture sector which in turn boost the agricultural as well as total income of the household. There is a positive relation between the diversification of family income and returns derived from the agriculture sector.

VI. REFERENCES

Agriculture in India. (2018). Retrieved from Wikipedia.

Akram, W., Naz, I., & Ali, S. (2011). An Empirical Analysis of Household Income in Rural Pakistan: Evidences from Tehsil Samundri. *Pakistan Economic and Social Review, 49* (2), 231-249.

Alobo, S., & Bignebat, C. (2017). Patterns and determinants of household income diversification in rural Senegal and Kenya. *Journal of Poverty Alleviation and International Development, 8* (1), 93-126.

Basantaray, A. K., & Nancharaiah, G. (2017). Relationship between Crop Diversification and Farm Income in Odisha — An Empirical Analysis. *Agricultural Economics Research Review, 30*, 45-58.

Chuang, Y. (2019). Climate variability, rainfall shocks, and farmers' income diversification in India. *Economics letters, 174*, 55-61.

Dalabehera, B., & Badatya, K. H. (2020). Changes in Income after Occupational Diversification- A study in Nayagarh District in Odisha. *Mukt Shabd Journal, 9* (7), 1226-1239.

Economy of Odisha. (2019-20). Retrieved May 5, 2021, from Wikipedia.

Gecho, Y. (2017). Rural Farm Households' Income Diversification: The Case of Wolaita Zone, Southern Ethiopia. *Social Sciences, 6* (2), 45-56.

Hanh, T. T., & Boonstra, W. (2018). Can income diversification resolve social-ecological traps in small-scale fisheries and aquaculture in the global south? A case study of response diversity in the Tam Giang lagoon, central Vietnam. *Ecology and Society, 28* (3), 1-20.

Harrera, G. P., Lourival, R., Brito da Costa, R., Mendes, D. R., Moreira, T. B., Abreu, U. G., et al. (2018). Econometric analysis of income, productivity and diversification among small holders in Brazil. *Land Use Policy* , 1-6.

Khan, W., Tabassum, S., & Ansari, S. A. (2017). Can Diversification of Livelihood Sources Increase Income of Farm Households? — A Case Study in Uttar Pradesh. *Agricultural Economics Research Review, 30*, 27-34.

Kirk, A., Kilic, T., & Calogero, C. (2018). *Composition of Household Income and Child Nutrition Outcomes Evidence from Uganda.* World Development.

Kumar, C. R. (2020). Crop Diversification and its Determinants: A Comparative Study between Cuttack And Kandhamal Districts of Odisha, India. *Journal of Global Resources, 6* (2), 43-48.

Pravin, M., & Akteruzzaman, M. (2012). Factors Affecting Farm and Non-Farm Income Of Haor Inhabitants Of Bangladesh. *Progress. Agric, 23* (1 & 2), 143-150.

Rutherford, J. B. (1938). Agricultural Income. *Canadian Economics Association, 4* (3), 420-431.

SDRC. (2020). *Odisha's Agri Workers are Among the Lowest Wage Earners in India*. Retrieved November 6, 2020, from Siddha Development Research and Consultancy: https://sdrc.co.in/odishas-agri-workers-are-among-the-lowest-wage-earners-in-india/

Sen, B., Venkatesh, P., Jha, G. K., Singh, D. R., & A., S. (2017). Agricultural Diversification and its Impact on Farm Income: A Case Study of Bihar. *Agricultural Economics Research Review, 30*, 77-88.

Sultana, N., Hossain, M. E., & Islam, M. K. (2015). Income Diversification and Household Well-Being: A Case Study in Rural Areas of Bangladesh. *International Journal of Business and Economics Research, 4* (3), 172-179.

Tripathy, S., & Das, S. (2020). Impact of crop diversification on tribal farmer's income: A case study from Eastern ghats of India. *econ.GN* .

Vatta, K., Singh, G., Sharma, N., & Bhoi, P. B. (2018). Regional dimensions and determinants of income diversification in rural India. *Agricultural Economics Research Review, 31*, 33-46.