THE CONTRIBUTION OF CROP INCOME IN REDUCING POVERTY AND INCOME INEQUALITY AMONG DIFFERENT FARM SIZES: A COMPARISON OF COTTON/WHEAT AND BARANI PUNJAB

Naila Hafeez[*], Muhammad Ashfaq, Irsa Sarwar and Amna Bari

Department of Agricultural Economics, University of Agriculture, Faisalabad, Pakistan
[*]**Corresponding author's e.mail: nyla_hafeez@live.com**

Crop sector shows an increasing trend but the benefits of this growth have shifted towards households having large land holdings leading to poverty and inequality in the economy. There is a need to decompose the crop income of households belonging to different farm sizes. This will ensure that proper policies can be made for the deprived groups to reduce overall poverty and inequality in the economy. The analysis has used data from Households Income and Expenditure Survey (HIES 2005-06). Decomposition measures, i.e., Gini coefficient and coefficient of variation have been employed for analysis. These measures decompose crop income into eleven different components according to different farm sizes to determine their impact on poverty. Results show that in Cotton/Wheat Punjab all households are receiving highest share of their crop income from wheat and cotton while in Barani Punjab, the major share of crop income is coming from wheat. In Cotton/Wheat Punjab, under the category No land to less than 5 acres, cotton is inequality increasing source while in Barani Punjab rice, maize and vegetables are inequalities increasing sources. Sugar cane, rice, maize, fruits and vegetables are inequality increasing sources in Cotton/Wheat Punjab while in Barani Punjab the category other crops is inequality increasing source under the category of households having 5 to less than 12.5 acres. Both decompositions agree that in Cotton/Wheat Punjab four income sources i.e. cotton, sugar cane, maize, and others, while in Barani Punjab maize, vegetables and other crops are inequality increasing sources of income among households having 12.5 to less than 25 acres.

Keywords: Crop income, income inequality, poverty, farm size

INTRODUCTION

The poverty is proliferating at a rapid pace in Pakistan and its occurrence in the rural areas is more evident. Besides other factors, poverty alleviation involves new ways of developing economies, usually this implies the development of the agriculture defined in a broader sense to include all uses of land and directly associated productive activities (Sharif *et al*., 2002). Irz *et al.* (2001) analyzed the relationship between agricultural growth and rural poverty and showed indirect relationship between the two. For example, a one-third increase in yield was expected to reduce the number of poor people by a quarter or more.

Agricultural growth specifically crop sector shows an increasing trend but the benefits of this growth have shifted towards higher income groups leading to poverty and inequality in the economy. The skewed land distribution is one of the major obstacles hindering the rapid reduction of rural poverty. More than half the total farms are smaller than 5 acres in size. Excessive land fragmentation and the sub-division of landholdings from generation to generation are causing a persistent decline in farm size, and, therefore, in agricultural productivity (Malik, 2005).

A number of studies in recent years have tried to show the relationship of different sources of income, income inequality and poverty in different countries but in Pakistan very little work has been done broadly. Therefore, this study contributes in the poverty and income inequality research by decomposing the crop income, to find out the contribution of eleven sources of income in crop income and income inequality across different farm sizes in two agro-climatic zones. This analysis is done by making a fine comparison between two agro climatic zones, because of the variability in percentage share of different sources of income in crop income and their poverty levels. The remainder of the paper is organized as follows: Section 2 presents the framework which will be used to analyze the role of different income sources in determining crop income inequality as measured by Gini coefficient and coefficient of variation. Section 3 describes the data used, section 4 discusses the results and section 5 offers conclusions with policy recommendations.

MATERIALS AND METHODS

Data of Household Income and Expenditure Survey (HIES) of Pakistan conducted by Federal Bureau of Statistics (FBS) in 2005-06 is used which is the basic source to examine the income inequality and poverty. A raising factor for each village is used to draw implications for the whole population.

This paper has used the methodology of Pickney (1989) to classify rural areas into zones. He classified the entire country into nine agro-climatic zones based on *Kharif* crops (cotton and rice mainly). Data of rural areas of different districts and divisions of two agro-climatic zones, i.e., Cotton/Wheat Punjab (Sahiwal, Bahawalnagar, Bahawalpur, Rahim Yar Khan, Multan, Vehari, Lodhran, Khanewal and Pakpattan) and Barani Punjab (Attock, Jhelum, Rawalpindi, Islamabad, Chakwal) has been used. The two zones have been selected on the basis of the expected considerable difference in crop income share in total income. The data about demographic variables, crop income and household expenditure has been analyzed. The concept of income used in this study reckons with income earned both in cash and kind.

Crop income has been decomposed by types of crops, i.e., wheat, rice, cotton, sugar cane, maize, feed, fruits, vegetables, by products etc. Household-level information on crops grown and harvested, inputs used, land holdings etc is used to calculate income and expenditures of households from crops. The crop expenditures include value of all the inputs used in the agricultural operation during the last Rabi and Kharif seasons. The inputs used in the crop production include seeds, chemical fertilizers, farm yard manure, pesticides, water, electricity and fuel charges, taxes, transportation, storage charges, payments to labor, rent of equipment etc.

Operated area has been calculated as the sum of owned land, land from crop shared base, land rented in and any other. Five categories of operated farm area have been used to make clear the difference in income distribution of the households having different landholdings. Categories are: i) No land to less than 5 acres ii) 5 to less than 12.5 acres iii) 12.5 to less than 25 acres iv) 25 to less than 50 acres v) 50 and above.

The methodology involves two steps: *First*, to find the contribution of different sources of crop income in total household income across different farm sizes, the following formula is used:

$$P.S_{Ci} = (Y_{Ci} / Y_C * 100 \ldots\ldots\ldots\ldots (1)$$

Where
i = 1, 2, 3,….., 11
$P.S_{Ci}$ = Percentage share in total crop income
Y_C = Total Crop income ($\sum Y_{Ci}$)
Y_{Ci} = Sources of crop income

Second, the contribution of different sources of income in crop income inequality has been determined by using decomposition analysis based on two inequality measures, i.e., Gini Coefficient and Coefficient of Variation. The source decomposition based on the coefficient of variation has been developed following Shorrocks (1982) and Ercelawn (1984). The crop income inequality has been decomposed into eleven sources. The decomposition corresponding to the Coefficient of Variation can then be expressed by defining the following terms:

$$\sum w_i c_i = 1; \; w_i = \mu_i/\mu; \; c_i = \rho_i(\sigma_i/\mu_i)/(\sigma/\mu) \ldots (2)$$

Where
i = 1,2,3,…..,11
$w_i c_i$ = factor-inequality weight of the ith source in overall inequality
c_i = relative concentration coefficient of ith source of crop income in crop income Inequality
ρ_i = correlation coefficient between ith source of crop income and total crop income
σ = Standard deviation of total crop income
σ_i = Standard deviation of ith source of crop income
μ_i = Mean crop income from ith source
μ = Mean crop income from all sources

The decomposition on the basis of the Gini coefficient developed by Pyatt *et al*. (1980) can then be expressed by defining the following terms:

$$\sum w_i g_i = 1; \; w_i = \mu_i/\mu; \; g_i = R_i(G_i/G) \ldots\ldots\ldots(3)$$

Where
i = 1,2, 3,…..,11
$w_i g_i$ is factor-inequality weight of the ith source in overall inequality and g_i is relative concentration coefficient of each crop income source in overall crop income inequality

$$G_i = (2/n_i\mu_i) \, cov(y_i,r_i) \ldots\ldots\ldots\ldots (4)$$

y_i and r_i shows the series of the crop income from ith source (wheat, cotton, sugar cane, rice, maize, pulses, fruits, vegetables, feed, by products, others) and their corresponding ranks respectively. And n_i is the reporting households (households with non zero total crop income). Total Gini (G) as a function of source Ginis has been calculated by:

$$G = \sum (\mu_i/\mu) \, R_i G_i \ldots\ldots\ldots\ldots (5)$$

Where
R_i is the correlation ratio, i.e.,

$$R_i = cov(y_i,r)/ \, cov(y_i,r_i) \ldots\ldots\ldots\ldots (6)$$

The income source having "c" or "g" greater or less than one will show increasing or decreasing income inequality respectively.

RESULTS AND DISCUSSION

It is evident from the results that in Cotton/Wheat Punjab households in almost all categories of farm sizes are receiving highest share of their crop income from wheat and cotton. Among all categories the 50 to above category is receiving the highest share of crop income from cotton. The reason is that, mostly households with large land holdings grow cotton as compared to small land holders. While in Barani Punjab the situation is opposite to it, where in almost all categories the major share is coming from wheat and not cotton. In Barani Punjab the wheat is contributing highest share in total crop income under the category 50 and above.

The households under first two categories devote relatively little land to cash crops like cotton and sugarcane compared with the other categories. Poor households usually lack the land needed to simultaneously grow sugarcane and food crops, and are reluctant to depend on the market for their food requirements. Because they are concerned about meeting their own food production needs, they tend to avoid planting a profitable crop like sugarcane (Adams and He, 1995).

Table 2 reports the relative concentration coefficients based on the decomposition of the coefficient of variation and the Gini coefficient in Cotton/Wheat Punjab among category No land to less than 5 acres. It is clear from the above data that cotton is inequality increasing source of income while remaining all crops are inequality decreasing sources of income. In Barani Punjab rice, maize and vegetables are inequality increasing sources while remaining all sources of income are inequality decreasing sources. The relative factor inequality weights of cotton in crop income inequality shows that it makes a larger contribution. The remaining all sources make smaller contribution to crop inequality. As Adams and

He (1995) in their study also concluded that income from a leading cash crop (sugar cane and cotton) has a large and negative effect on income distribution; income from the main food crops (wheat and rice) has an equalizing effect.

Table 3 shows that in Cotton/Wheat Punjab sugar cane, rice, maize, fruits and vegetables are inequality increasing source of income because these sources have g_i and c_i greater than 1 while in Barani Punjab the crops under the category other are inequality increasing. Malik (2005) also examined that within crop income, the poor rely mainly on food crops such as wheat, while the rich diversify crop production by growing more cash crops such as sugarcane and cotton. The remaining sources are inequality decreasing sources because these sources have g_i and c_i less than 1. In Cotton/Wheat Punjab, vegetables are inequality increasing sources. The correlation ratio of vegetables also shows that it creates large income gap between small and large land holders. Contrary Barani Punjab, wheat has a high correlation ratio.

Table 4 explains on the basis of the relative concentration coefficients that in Cotton/Wheat Punjab for the category 12.5 to less than 25 acres four income sources i.e. cotton,

Table 1. Distribution of crop income from different sources among different farm sizes in two zones (%)

Zones	Operated area (Acres)	Wheat	Cotton	Sugar cane	Rice	Maize	Pulses	Fruits	Vegeta bles	Feed	Other	By products
Cotton/ Wheat Punjab	No land to <5	41.54	36.03	0.33	-	-	-	-	0.37	14.87	1.28	5.58
	5 to 12.5	30.67	33.37	3.58	3.26	2.43	0.54	2.06	2.61	14.98	0.78	5.72
	12.5 to <25	30.28	42.68	4.61	1.43	1.30	0.47	0.30	0.74	7.88	4.52	5.79
	25 to < 50	39.80	29.88	1.31	1.83	4.12	3.95	2.00	0.30	7.72	3.90	5.18
	50 and above	28.31	48.42	0.61	0.11	5.44	0.25	-	5.47	6.40	-	5.00
Barani Punjab	No land to <5	80.74	-	-	-	2.55	-	-	-	16.72	-	-
	5 to 12.5	64.52	-	-	0.55	11.59	1.28	-	1.48	7.76	12.05	0.77
	12.5 to <25	63.37	-	-	-	21.36	-	-	12.49	0.65	2.14	-
	25 to < 50	25.86	-	-	-	-	-	-	-	2.24	71.90	-
	50 and above	87.84	-	-	-	-	-	-	-	-	12.16	-

Table 2. Decomposition of crop income inequality among households having no land to less than 5 acres in Cotton/Wheat and Barani Punjab

Crops	Cotton Wheat Punjab						Barani Punjab					
	R_i	g_i	c_i	w_i	w_ic_i	w_ig_i	R_i	g_i	c_i	w_i	w_ic_i	w_ig_i
Wheat	0.87	0.94	0.79	0.31	0.24	0.29	0.96	0.96	0.97	0.70	0.68	0.67
Cotton	0.82	1.20	1.06	0.36	0.38	0.43	0.00	0.00	0.00	0.00	0.00	0.00
Sugarcane	0.65	1.43	0.75	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Rice	0.29	0.60	0.15	0.02	0.00	0.01	0.63	1.27	8.36	0.01	0.06	0.01
Maize	0.50	1.10	0.45	0.01	0.01	0.01	0.82	1.32	1.23	0.14	0.17	0.18
Pulses	-0.39	-0.89	-0.53	0.00	0.00	0.00	0.29	0.58	0.70	0.01	0.00	0.00
Fruits	0.61	1.36	0.57	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Vegetables	0.49	1.07	0.38	0.03	0.01	0.04	0.77	1.49	1.54	0.02	0.02	0.02
Feed	0.46	0.67	1.64	0.17	0.28	0.12	0.88	0.93	0.77	0.09	0.07	0.08
Other	0.31	0.69	0.18	0.01	0.00	0.00	0.37	0.70	0.19	0.04	0.01	0.03
By products	0.84	1.04	0.86	0.06	0.05	0.06	0.36	0.68	0.27	0.01	0.00	0.01
Total	1.00	9.23	1.00	1.00	1.00	1.00	1.00	7.93	14.02	1.00	1.00	1.00

Table 3. Decomposition of crop income inequality among households having 5 to less than 12.5 acres in Cotton/Wheat and Barani Punjab

Crops	Cotton Wheat Punjab						Barani Punjab					
	R_i	g_i	c_i	w_i	w_ic_i	w_ig_i	R_i	g_i	c_i	w_i	w_ic_i	w_ig_i
Wheat	0.68	0.74	0.72	0.31	0.22	0.23	0.85	0.88	0.94	0.56	0.53	0.49
Cotton	0.62	1.07	0.95	0.32	0.30	0.34	0.00	0.00	0.00	0.00	0.00	0.00
Sugarcane	0.65	1.85	1.75	0.05	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00
Rice	0.65	1.82	2.53	0.04	0.10	0.07	0.00	0.00	0.00	0.00	0.00	0.00
Maize	0.43	1.19	1.14	0.03	0.04	0.04	0.54	0.89	0.18	0.06	0.01	0.05
Pulses	-0.17	-0.51	-0.51	0.01	0.00	0.00	0.09	0.15	-0.20	0.03	-0.01	0.00
Fruits	0.59	1.75	1.87	0.02	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Vegetables	0.81	2.39	3.42	0.02	0.07	0.05	0.36	0.00	-0.04	0.01	0.00	0.00
Feed	0.50	0.80	0.69	0.14	0.09	0.11	0.43	0.00	-0.05	0.08	0.00	0.00
Other	-0.15	-0.45	-0.39	0.01	0.00	0.00	0.97	1.67	1.76	0.27	0.47	0.44
By products	0.65	0.97	0.86	0.06	0.05	0.05	0.74	1.30	0.26	0.01	0.00	0.01
Total	1.00	11.62	13.03	1.00	1.00	1.01	1.00	4.88	2.86	1.00	1.00	1.00

Table 4. Decomposition of Crop Income Inequality among households having 12.5 to less than 25 acres in Cotton/Wheat and Barani Punjab

Crops	Cotton Wheat Punjab						Barani Punjab					
	R_i	g_i	c_i	w_i	w_ic_i	w_ig_i	R_i	g_i	c_i	w_i	w_ic_i	w_ig_i
Wheat	0.83	0.80	0.69	0.30	0.21	0.24	0.78	0.48	0.46	0.63	0.29	0.31
Cotton	0.86	1.21	1.02	0.43	0.44	0.52	0.00	0.00	0.00	0.00	0.00	0.00
Sugarcane	0.47	1.29	1.01	0.05	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00
Rice	0.27	0.72	1.49	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Maize	0.96	2.76	5.84	0.01	0.08	0.04	0.77	1.75	1.54	0.21	0.33	0.37
Pulses	-0.05	-0.13	-0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fruits	-0.28	-0.78	-0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vegetables	-0.35	-0.86	-0.80	0.01	-0.01	-0.01	1.00	2.88	3.15	0.12	0.39	0.36
Feed	0.33	0.55	0.40	0.08	0.03	0.04	0.09	0.25	-0.54	0.01	0.00	0.00
Other	0.44	1.22	3.21	0.05	0.15	0.06	-0.48	-1.26	-0.56	0.02	-0.01	-0.03
By products	0.76	0.86	0.75	0.06	0.04	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.00	7.63	12.80	1.00	1.00	1.00	1.00	4.11	4.06	1.00	1.00	1.02

sugar cane, maize, and others crops represent inequality-increasing sources (c_i and g_i > 1) of crop income. While in Barani Punjab maize and vegetables are inequality increasing sources of income. The relative concentration coefficients show that all the remaining sources of agricultural income are inequality-decreasing sources of income. The correlation ratio of maize also shows that it creates large income gap between small and large land holders.

CONCLUSIONS AND RECOMMENDATIONS

Policymakers need to realize that most of the direct benefits from cotton are likely to go to those households that own large land holdings. As a result; they receive over more than 30 percent of their agricultural income from this single crop. These findings suggest that government officials should focus on technologies for producing wheat and rice, the main food crops, because these account for a large share of the agricultural income for the small landholders. Small land holders should be provided with facilities like provision of credit, training, extension services etc so that they can improve crop productivity.

REFERENCES

Adams, R.H. and J.J. He. 1995. Sources of Income Inequality and Poverty in Rural Pakistan. Research Report 102. IFPRI, Washington, DC.

Ercelawn, A. 1984. Income inequality in rural Pakistan: A study of sample villages. Pak. J. Appl. Econ. 3:1-28.

Government of Pakistan. 2006. Household Income and Expenditure Survey (HIES 2005-06). Statistics Division, Federal Bureau of Statistics, Pakistan.

Irz, X., L. Lin., C. Thirtle and S. Wiggins. 2001. Agricultural productivity growth and poverty alleviation. Develop. Policy Rev. 19:449-466.

Malik, S.J. 2005. Agricultural Growth and Rural Poverty: A Review of the Evidence. Working Paper No.2, Pakistan Resident Mission Working Paper Series, Asian Development Bank, Islamabad.

Pickney, T.C. 1989. The Demand for Public Storage of Wheat in Pakistan. Research Report IFPRI, Washington, DC.

Pyatt, G., C. Chen and J. Fei. 1980. The distribution of income by factor components. Quart. J. Econ. 95:451-473.

Sharif, M., U. Mustafa, W. Malik and M. Iqbal. 2002. Land distribution and renewal of sustainable economic activities for rural poverty alleviation in Pakistan. Int. J. Agri. Biol. 4:413-419.

Shorrocks, A.F. 1982. Inequality decomposition by factor components. Eco. 50:193-211.