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PATTERNS OF RELATIONSHIPS BETWEEN FARM AND NONFARM SOURCES OF INCOME IN THE RURAL AREAS OF THE NORTHERN PROVINCE

M. Makhura[1]

The objective of this paper is to identify patterns of relationships among farm and nonfarm income activities. Factor analysis (FA) (model) is applied on eleven income generating activities in the rural areas of the Northern Province. The principal component extraction method was used to extract five factors which reflected three patterns of farm-nonfarm relationships. The first pattern showed a complete inclination to farming activities. The two factors in this pattern involved traditional farming activities (maize and livestock sales) and diversified arable activities (sales of vegetables and other field crops). The second pattern reflected linkages to achieve the income objective (salaries and fruit sales) as well as food security (income from pensions and exchange for finished product). The last pattern pertained to nonfarm options; either business and services or wages. Programmes for rural development should aim to enhance the contribution of both agricultural and non-agricultural sectors to poverty alleviation by strengthening linkages between the sectors..

1. INTRODUCTION

Rural incomes are generally low, and poverty tends to manifest itself in the rural areas in South Africa (May, 1998). Since the establishment of local governments, attempts have been made to create viable rural economies in order to eradicate poverty (Local Government, 1997 and Makhura, 1999). A major element of such economies is the synergy between farm and non-farm sectors (De Janvry, 1994 and Makhura, 1999) which will ultimately ensure growth (Reardon, 1996 and Delgado *et al*, 1998).

To generate livelihoods, farming households resort to diversified income sources (Reardon *et al*, 1992 and Reardon, 1996). The question is whether there is any discernible pattern of relationship between farm and nonfarm income sources. The specific question is "Do farm household combine the sources in a particular way as they strive to survive or do they use them individually?" The objective of this paper is to identify the pattern of relationships between farm and nonfarm income sources. Identifying these patterns can be extremely useful in recommending policy interventions and strategy to promote growth and poverty alleviation in the rural areas (Kirsten, 1995).

[1] *Department of Agricultural Economics; Extension and Rural Development, University of Pretoria, Pretoria.*

2. FARM-NONFARM LINKAGES IN THE RURAL ECONOMY

For rural development and growth to take off sustainably, linkages are eminent (Delgado *et al*, 1998). The linkages between farm and nonfarm activities are documented in various ways. In certain cases, households are classified into wage earners and nonwage earners (McComb *et al*, 1994). Accordingly, nonwage earners depend more on agriculture while age earners rely on the nonfarm sector for their income. This classification is problematic since it does not capture linkages between wage and nonwage earning sources. Islam (1997) emphasized the importance of linkages by identifying three ways in which farm-nonfarm linkages can improve income distribution as follows:

- Farm-nonfarm linkages help to reduce inequalities in income distribution and rural poverty. The nonfarm sector supplement employment and income for the landless workers and marginal farmers who cannot obtain enough income and sustenance from agriculture (von Braun and Kennedy, 1994).
- Within the limits of human capital development, the interaction between farm and nonfarm sectors helps to maintain the real income of the poor who have limited purchasing power.
- Farm-nonfarm linkages further enable the poor to smooth out or offset income fluctuations through income diversification (Niemeijer & Hoorweg, 1994).

The effectiveness of the linkages depends on the strength and nature of linkages as well as types of activities involves (Islam, 1997). Rural households are involved in various actities as identified in Kirsten (1995). In this paper farming activities include maize, other field crops, fruit, vegetables and livestock. Nonfarm activities are defined in terms of participation in own business, salary and wage earning activities, government pensions and providing services.

3. DATA AND FACTOR ANALYSIS MODEL

The data used in this paper was obtained from interviews using a structured questionnaire. This was administered to 158 farming households in the randomly selected districts of the Northern Province. Farmers were asked to indicate their farming activities per product in terms of amount produced, sold, consumed and exchanged for finished produce. They were further asked

to indicate income received from nonfarm sources by each member of the household. These sources were then controlled for household size differences by dividing income by adult equivalent. The question was whether there was any pattern of relationship among these variables. Factor analysis is an appropriate technique to answer such questions (Makhura *et al*, 1997) by describing the covariance relationships among many variables into fewer underlying, but unobservable, random quantities called *factors* (Johnson & Wichern, 1992; Hair *et al*, 1995; Gouse, 1999). The FA model is organised in such a way that all variables within a particular group are highly correlated among themselves but have relatively small correlations with variables in another group.

The factor analysis model in matrix form can be expressed as

$$\mathbf{x} = \Lambda \mathbf{f} + \mathbf{e}$$

where

x is the vector of p observable variables, **f** is the vector of m unobservable factors, Λ is the loading matrix of the order $p \bullet m$ (loadings given by λ's) and **e** is the error vector of $p \bullet 1$. The model assumes that

- **f**: $m \bullet 1 \sim N(\mathbf{0}, \mathbf{I_m})$; that is the m common factor variates in **f** are iid with zero mean and unit variance.
- **e**: $px1 \sim N(\mathbf{0}, \mathbf{D}_\psi)$; that is, the errors (specific factors) are normally and independently distributed with zero mean and variance

$$Var(e_i) = \psi_i = [\mathbf{D}_\psi]_{ii}$$

- the variates **f** and **e** are independently distributed.

From above formulation, it follows that

- $Var(\mathbf{x}) = \Lambda\Lambda^T + \mathbf{D}_\psi$, and the ith **diagonal element** of $\Lambda\Lambda^T$ is the **communality** of ith variable.

- $Cov(\mathbf{x}, \mathbf{f}^T.) = \Lambda$

The aim of factor analysis is to account for the correlations or for the covariances between the response variables in terms of a smaller number of factors. In empirical analysis, the unknown parameters λ's and ψ_i require

estimations. These parameters have been estimated in determining food buying habits (Herrman & Warland, 1990), sources of risk (Bullock *et al*, 1994) dairy management (Ford & Stokwiller, 1994), and market participation (Makhura *et al*, 1997). This study attempts to estimate parameters in order to determine the pattern of relationships among farm and nonfarm income sources.

4. EMPIRICAL RESULTS

4.1 Description of income sources per adult equivalent

The mean earnings for various farm and nonfarm sources were computed. This section presents some descriptive results of the two categories.

Farming activities were indicated by seven variables. Five of these variables measured the value of sales in maize, other field crops, fruit, vegetables and livestock. Two of the variables measured the value of farm items exchanged for processed products and implicit value of own consumption (Table 1).

Table 1: Income (AE) from Farming Activities (R)

	Mean	Standard Deviation
Maize sale	80	245
Field crops sales	117	330
Fruit sales	353	2020
Vegetables sales	83	371
Livestock sales	113	455
Total direct sales	***746***	***2129***
Value of exchange	223	370
Value-added by household	153	177
Value of Agriculture	**1122**	**2205**

The total direct sales is R746 per AE. To this, fruit made the largest contribution (R353), followed by field crops (R117), livestock (R113), vegetables (R83) and maize (R80). Ostensibly, maize sales contributed least since it was either exchanged or home consumed. The mean value of exchange per AE is R223 and that of own consumption is R153. The mean total value of farming activities is R1123.

Five *nonfarm activities* were identified. Table 2 indicates the mean earnings per AE from nonfarm activities. Salaries or earnings from government

employment made the largestcontribution to total nonfarm income with mean income per AE estimated at R1268. Pensions or government payout were second with mean earning per AE of R843, followed by wages (about R665). Self-employment activities (business and services) were least contributors with mean earnings of about R379 and R412 respectively. These results reflect that government supported nonfarm activities contribute more to per capita income than independent activities. However, it is imperative to identify the pattern in which these nonfarm activities link with farm activities to improve incomes of farming households.

Table 2: Income (AE) from nonfarm sources (R)

	Mean	Standard Deviation
Business	379	1613
Pensions	843	1126
Services	412	1211
Salaries	1268	3697
Wages	665	1333
Total nonfarm	**3566**	**4218**

4.2 Results of factor analysis

About twelve variables indicating farm and non-farm sources of income were subjected to factor analysis procedure in SPSS. In the first run the implicit value of own consumption loaded moderately to multiple factors, implying that it was linked to most of the activities. The variable was then removed. Factor analysis procedure was rerun with eleven variables. Five factors were extracted (using PC extraction method) according to the criterion of eigenvalues of greater than unity. The five factors explained 63,6 percent of the total variance in the sample, which is reasonable for analysis. Table 3 presents a matrix of loadings (Λ). The factor analysis results reflect three patterns of farm-nonfarm relationships: Complete farming (Factors 1 & 2), farm-nonfarm links (Factors 3 & 4), and complete nonfarm (Factor 5) orientation.

First pattern: complete farming orientation

Factor 1 (or Traditional Farming) in column 2 explained 16,5 percent of variance in the data. Income from maize and income from livestock loaded highly in this factor. Maize is typically used as a staple food, thus applied for security reasons. On the other hand, livestock is kept as a form of social status. This pattern is associated with communal setting where communal arable

allotment and access to grazing facilities are sources of livelihood. Nonfarm activities are less important in this situation. As such, certain conditions encourage farmers to sell some of their maize and livestock, mainly earning income in order to access other goods.

Factor 2 (or Arable Farming) in column three explained 13,6 percent of the variation in the data. Income per adult equivalent from other field crops and vegetables loaded heavily in this factor. Field crops are generally applied to provide food requirement, while vegetables are produced for cash. Further, field crops are grown under dryland while vegetables are grown under irrigation. This pattern is associated with the setting where there is communal dryland area and accessible irrigation infrastructure.

Table 3: Factor scores (λ) for sources of income per adult equivalent

	Factor 1 Tradi-tional	Factor 2 Arable	Factor 3 High income	Factor 4 Food security	Factor 5 Nonfarm	Commu-nality
Business	.146	-.019	-.008	-.174	**.383**	.483
Other field crops	-.034	**.516**	-.032	.124	.059	.581
Fruit	-.056	-.175	**.645**	.104	.053	.755
Livestock	**.523**	-.118	-.004	-.022	-007	.756
Maize	**.557**	.106	.014	.152	-.131	.775
Value of exchange	.083	-.058	.156	**.587**	-.044	.602
Pensions	.010	.014	-.155	**.545**	.031	.626
Salaries	.061	.132	**.516**	-.074	-.040	.611
Services	-.023	-.134	-.064	.020	**.553**	.560
Vegetables	.018	**.567**	-.035	-.166	-.062	.646
Wages	.178	-.202	-.102	-.067	**.576**	.596
Percentage of Variance (ψ)	**16.5**	**13.6**	**12.9**	**10.8**	**9.8**	
Cumulative Percentage	**16.5**	**30.1**	**43.0**	**53.8**	**63.6**	

Second pattern: Farm-nonfarm income linkages

Factor 3 (or high income earnings) in column four explained 12,9 percent of the variation in the data. Income per adult equivalent from fruit sales and salaries loaded heavily in this factor. Salaries are mainly from government and tend to create an upper income class in the rural areas. Salaries are used to finance the establishment of orchards established through government assisted projects.

In addition, salary earners have access to more information regarding government projects. In fact, certain government projects in the eighties targeted public servants to raise their interest in agriculture.

Factor 4 (or food security) in column five explained about 10,8 percent of the variation in the sample. Income per adult equivalent from pensions and the value of exchange for processed produce loaded heavily in this factor. Typically, farm produce is either sold or consumed. This decision is problematic when inadequate amounts are produced. When pensions are received the income is used to purchase food to supplement own production. In several cases, income from pensions is used to provide for other basic needs. In that case, food produced is exchanged for processed food collected at latter time. In addition, the income from pensions is used to pay for transport, storage and/or processing of farm produce.

Third pattern: nonfarm alternatives

Factor 5 (or Non-Farm Alternatives) in column six explained 9,8 percent of the variation in the data. Only nonfarm income sources loaded heavily in this factor. Income per adult equivalent from businesses and income from services loaded with the same sign (negative). On the other hand income from wages loaded with a positive sign. This implies that when business and services become important, wages will be less important. This is due to the fact that wages are earned predominantly by migrants, whereas businesses and services are local activities. The other reason could be that business and service activities do not generate significant wage employment. If they do, households owning businesses and providing services do not earn wage incomes, and vice versa. This could be an important area for policy aimed at promoting job creation by business

5. SUMMARY AND CONCLUSIONS

Factor analysis identified three general patterns or nature of farm-nonfarm relationships. The first category reflected domination of farming activities in two factors; they reflected traditional attitude to maize and livestock production and diversification in arable farming activities. In this case, there is a complete dependence on agriculture. The dynamics of that dependence is immersed in the orientation to diversification. As such, intervention in agricultural development should take account of diverse farming practices and enterprises commanded by the rural households.

The other pattern reflected farm-nonfarm linkages; linkages to generate high incomes through salaries and high value crops and the linkage to ensure food security through pensions and exchange for value added produce. In this situation reliance on farming is stabilised by nonfarm income. The final general pattern reflects nonfarm activities where the role of business and services is negatively related to the role of wage earning activities. This pattern is a response to failing conditions in farming. Policies should make the environment conducive to the uptake of nonfarm income activities, especially when there are possibilities of failures in farming.

Farming activities are more important to the rural households as compared to non-farm incomes. This is evidenced by the highest percentage of variance explained (about 31%) in contrast to about 10 percent explained by nonfarm income activities. Thus, interventions to alleviate poverty in rural areas cannot be effective without appropriate policies to develop agriculture. Income from farm-nonfarm linked factors is second to farming in explaining the variation of incomes in the rural areas (about 23,7 %). Thus, the linkages must be managed in an integrated way.

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