FACTORS DETERMINING OFF-FARM EMPLOYMENT ON SMALL FARMS IN DISTRICT NOWSHEHRA OF NORTH WEST PAKISTAN

MUHAMMAD TAHIR*, HUMAYUN KHAN* and ABDUL QAHAR**

* Institute of Development Studies, Agricultural University, Peshawar – Pakistan.
** Angro Foods Private Limited – Pakistan.

ABSTRACT

There exists high level of under employment in agriculture sector in agrarian and transitory economies. Industrial growth and capacity is not enough to accommodate surplus labour existing in the agricultural sector which give way to unemployment and the expansion of non-farm sector (unorganized service sector). This shift of livelihood has socio-economic implications for a transitory economy like Pakistan. Aim of the present research is to investigate and assess the factors contributing to off-farm employment in North West Pakistan. For this purpose data were collected from purposively selected villages in district Nowshera, Pakistan in 2008. OLS technique was used for data analysis. Findings of the study show that farm-size, family-size, farm-underemployment, education, and income-from-other-sources were the main factors determining off-farm employment in the study area. It was also observed that farmers of the comparatively developed areas devote more time to off-farm employment. This could be associated to the developed means of transport and communications, better education facilities as well as availability of off-farm jobs locally. The study revealed that most of the farmers were engaged in daily paid labour. However, a considerable number of farmers were also engaged in trade and commerce jobs and part time employment with the private firms. Overall there is a gradual shift from farm to off-farm employment which is resisted by the underdeveloped means of transport and communication, education and lack of basic infrastructure.

Key Words: Off Farm Employment, Transition Economies, Livelihood Diversification, Small Farms, Pakistan.

INTRODUCTION

The Lewis’s (1954) theory of economic development describes the existence of a traditional labour intensive agricultural sector which is rural based with low wage and surplus labour; and a modern capital-intensive industrial based urban sector marked with high wage and better productivity. Attracted by high wage rate surplus labour from the traditional sector gradually flows to the modern industrial sector. As a consequence of this the share of the industrial sector in the GDP gradually increases. Lewis in this way described the process of economic development in which an economy gradually switch over from agricultural to industrial sector.

![Percentage Share of Agriculture Sector in the GDP and Labour Force Employment of Pakistan](source: Economic survey of Pakistan 2007)
Agriculture is the largest sector of the economy of Pakistan. It accounts for over 20% of GDP and accommodates 43.4% of the total work force (GOP, 2007). But despite growth in the agricultural sector the share of agriculture in national GDP and its labour force employment has decreased over time (Fig. 1).

The figure demonstrates a declining trend in the share of agriculture in both GDP and labour force employment. Moreover decrease in GDP is larger than employment which is a clear indication of the low productivity and existence of surplus labour. This low productivity and underemployment results in low income and thus is also a main source of poverty, which is pervasive in the rural areas where agriculture is the main source of livelihood.

On the other side share of industrial sector in GDP and employment in Pakistan has grown over the years. Its share in the GDP was only 9.30% during the year 1959-60, 13.01% during 1984-85, 17.80% during 1990-91 and 19.10% in the year 06-07. Industrial employment has increased in real terms. However its share as a percentage of total employment has not increased significantly. Industrial sector employed 13.60% of the total labour force during 1963-64 which stood almost the same i.e. 13.73% during 2006-07 (GOP, 2006). This illustrates slow growth of the industrial sector as well as low capacity to accommodate the surplus labour of the country.

The prevalence of high level of unemployment and underemployment in the rural-agricultural sector, low productivity and income, and smaller labour absorption capacity of the industrial sector has given way to a swelling service and informal sector. At present the service sector accommodates 34.95% labour force in Pakistan (GoP, 2007). Since jobs in the formal-agri/industrial- sector are not available in the required number so there is a trend of increase in self-employment in transport, trade, commerce, poultry farming, small and medium enterprise and daily paid labour (GoP, 2007). Due to low income from crops farmers are compelled to supplement their income by engaging in these informal sectors, which has gradually changed the economic landscape of rural areas of Pakistan. Income from off-farm employment supplements the low farm income of a large number of rural populations.

Income derived from off-farm employment to rural households represents a substantial share of rural income (Davis, 2003). There is evidence that income from off-farm employment constitutes an important part of the budget of rural households. Income from rural non-farm sector accounts for 35-40 percent across the developing world. This sector produces 42% income in Africa, 40% in Latin America, and 32% in Asia (Haggblade et al. 2002). Bezemer and Davis (2003) established that the average non-farm income share of rural households in some CEE countries was 30% to 70%. Ellis (2000) has given appreciably higher estimates for South Asia. At present about 40% of the rural population in Pakistan is directly dependent on non-farm income (GOP, 2006). These contributions of off-farm income are becoming increasingly significant for food security, poverty alleviation, farm sector competitiveness and productivity (Davis and Cristoiu, 2001).

In Pakistan majority of the population living in rural areas are mainly deriving their livelihood from agriculture and related activities. Over the years, the contribution of manufacturing sector in terms of income generation has increased. However, industrial growth and its capacity is not enough to accommodate surplus labour existing in the agricultural sector. As a result, the non-farm sector is expanding. This shift of livelihood has socio-economic implications for a transitory economy like Pakistan. The focus of rural development and poverty alleviation policies in Pakistan focused on the development of agriculture sector and little importance has been given to the emerging rural non-farm sector. For the development of the non-farm sector it is important to investigate the factors responsible for the growth of this sector. The present study is an effort in this regard.

Main objective of the study is to determine the factors affecting off-farm employment of the small farmers in the selected villages of Distt; Nowshera, Khyber Pakhtunkhwa, Pakistan. It is hypothesized that the farmers with large families, lesser cultivation land, and better education will devote more time to off-farm employment and will spend less time to on farm activities.

**Frame Work of Analysis**

**Data Sources and Selection of Sample Villages**

The study is based on primary data collected in Feb-March 2008, from two villages of district Nowshera of the province Khyber Pakhtunkhwa of Pakistan. Selection of villages was made on the basis of socio-economic features of these villages using purposive sampling technique. The main features required were to select villages with agricultural background but where development of infrastructure and other socio economic factors have resulted in the diversified the livelihood. Also we need to consider the backwardness and development factors [also
known as external factors e.g. road infrastructure, health facilities etc.] of the villages, so that we can compare the impact of different internal factors like household size etc. of different villages.

On this criterion, Akbarpura, a comparatively developed town and Kurvi, a comparatively less developed village were selected. Akbarpura town is located about 15 Kilometer from the provincial capital Peshawar, having almost all type of infrastructural facilities including; transport, communication, education, health, and allied markets for various commodities. In contrast to that, Kurvi is a backward village lacking all the major facilities mentioned above. The dominant source of livelihood is agriculture in both the villages.

Sampling Technique and Sample Size

Census is always difficult because of time and financial constraints. Sampling helped in minimizing these constrains. However, the results of such studies based on sampled data can be generalized only if the sample selected is a true representative of the targeted population. Sampling theory and techniques are used to assure the selection of sample size that is a true representative of the targeted population (Aurangzeb, 1991). Sample size in this study is determined with the following formula:

\[ n = \frac{K^2 \delta^2}{Ne^2 + K^2 \delta^2} \]

“Variance \( \delta^2 = \frac{e}{K} \), where \( K = 3 \) and e (error) is 5% so \( \delta^2 = 0.01667 \)”

Where

- \( n \) sample size,
- \( K \) maximum accepted error. It is one third of the sample variance and its maximum value is 3,
- \( \delta^2 \) variance,
- \( e \) error, and
- \( N \) size of the population (total farm household for this study)

The minimum sample size so obtained was 110; with 60 samples from Akbarpura and 50 from Kurvi.

Random sampling technique is used to select the sampled respondents so that selection bias can be get away with.

In village Akbarpura \( N = 800 \) thus Sample Size computed was 56; in village Kurvi \( N = 200 \) and the sample size derived was 46; thus total Sample Size was 102.

Models Selection and Specification

The popular econometric techniques used in these kinds of research are logistic models e.g. Logit and Probit (Giorgi 2001, Janowski and Bleahu 2001 and Davis et al. 2004). By its very nature these models give probability of the existence or absence of a feature. However, in these models dependent variable is least affected by the magnitude of the independent variables. Another problem associated with these models is that the signs of parameters can’t be confidently interpreted (Gujrati, 2004). On the other side in the OLS analysis the dependent variable is affected by the magnitude of the independent variable and thus can provide more precise and consistent results. Besides that this technique, by the virtue of its BLUE properties, is free of both drawbacks of the logistic models. However, it should be cared that the results of OLS’s models are valid when the basic assumptions of the model like non existence of multicollinearity, autocorrelation and heteroscedasticity are not violated. In this study the OLS technique is applied to analyze the data.

Specification of the econometric model applied for the study is given below:

\[ Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + u_i \]  

(1)

where

- \( \beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7 \) and \( X_{8i} \) are parameters,
- \( Y_i \) represents off-farm employment of farmer analyzed in the hours spent per day by a farmer in off-farm job,
- \( X_{1i} \) farm size operated by the farm family measured in acres,
- \( X_{2i} \) family/household size of the farmer,
- \( X_{3i} \) income per month from farm output per month in Pak Rupees,
- \( X_{4i} \) farm under-employment measured in the hours per day,
- \( X_{5i} \) farmer’s year of education,
- \( X_{6i} \) age of the respondent in years.
\( X_{7i} \) livestock holding in numbers,
\( X_{8i} \) Income per month from other sources measured in Pak Rupees,
\( u_i \) stochastic error term.

This variable includes rental income, pension, pay/wages of other members of the household etc. Since the largest share of this income belongs to the income generated by family members out of farms mostly living in other areas of the province or country so it can serves as an instrumental variable which can help to analyze the affect of the livelihood activities of the household members other than farmers, on the off-farm activities of their household.

**Justification of Variables**

Variable Farm Size is supposed to affect the off-farm employment because larger the farm size will increase on farm activities and less time will be left for off-farm activities. Furthermore farm production and hence income from farm will be higher and the farmer will not be in need of generating extra income from off-farm activities. The second variable i.e. family size; is justified as large family require more income for fulfilling their daily needs and hence will force the farm operator to bid for off-farm activities. On the other side large farm provide extra family labour to the farmer and give him a cushion to leave for off-farm job. The larger the under employment the greater will be devotion to off-farm activities and vice versa. Large income from farm output is assumed to be negatively related and vice versa, as the farmer will be comfortable with the farm earning. Underemployment is assumed to be positively related to the dependent variable and vice versa, as it will provide extra time to the farmer to devote to off-farm employment.

Educated farmers are supposed to devote less time to farm activities because they have more chances of getting off-farm employment. Furthermore farming is considered to an inferior job in Pakistani society and mostly educated people avoid farming thus their engagement in off-farm activites is supposed to be positively related to the dependent variable. Age is a tricky variable as in young age opportunities of off-farm employment is usually high and thus farm activities will be less; hence more the age less will be off-farm employment. However if a farmer is doing off-farm activities from his youth his age may be more but the above relation will not be true for him due to his experience. Thus this variable may go both ways. Income from other sources is hypothesized to be negatively related to the off-farm employment because this mitigates the stress for extra income. Furthermore it increase migration and reduce the family labour on farm thus force the farmer to stick to his land. Off-farm employment of the farmers of the two villages is compared with the following dummy variables multiple regression model.

\[
Y_i = \beta_1 D_{i1} + \beta_2 D_{i2} + u_i, \ldots (2)
\]

Where;
\( \beta_1 \) and \( \beta_2 \) are parameter
\( Y_i \) level of off farm employment of respondent \( i \)
\( D_{i1} \) 1 if respondent \( i \) belongs to Akbarpura, 0 otherwise
\( D_{i2} \) 1 if respondent \( i \) belongs to Kurvi, 0 otherwise
\( u_i \) stochastic error term

**Empirical Evidence**

**Socio Economic Characteristics of the Sampled Respondents**

Socio-economic characteristics of the respondents including age, literacy status/level, tenural-status and family size are given in the following table. All these characteristics have close association with the objectives of the present study.

The data reveals that majority of the respondents (77%) were above 30 years of age. Due to low income and large families most of the farmers in the study area send their male youth (age 30 years and below) to other cities in search of better employment. Educational level of the sampled respondents was low in both of the villages. However, the literacy rate of the farmers in Akbarpura was better than the farmers of Kurvi. It reveals the fact that educated people were not engaged in farming. It may be because of the existence of high opportunity cost for the educated people in farm sector mainly due to low wage and return and general respect for white collar jobs. The data also reveals that the study area is dominated by the owner cultivators. The dominance of owners in the small and marginal farmers of the area, in particular in village Kurvi, may be due to the non-availability of off-farm jobs and
backward transport facilities, which compelled the farmers to stick to their marginal farms in order to make their both ends meet. On the other side in Akbarpura, to some extent, the owners are small in number, which may be due to the availability of off-farm jobs, better transport and higher educational level of the people in general. These factors enable them to rent out their small farms and get better employment in the non-farm sector locally or in other adjacent areas.

Table I Socio economic characteristics of the sampled respondents

<table>
<thead>
<tr>
<th>Feature</th>
<th>Akbarpura</th>
<th>Kurvi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-30 years</td>
<td>14</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>31-45 years</td>
<td>25</td>
<td>11</td>
<td>43</td>
</tr>
<tr>
<td>46-60 years</td>
<td>21</td>
<td>28</td>
<td>49</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>31</td>
<td>30</td>
<td>61</td>
</tr>
<tr>
<td>Primary</td>
<td>05</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Middle</td>
<td>02</td>
<td>06</td>
<td>08</td>
</tr>
<tr>
<td>Secondary</td>
<td>11</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>Intermediate</td>
<td>05</td>
<td>04</td>
<td>09</td>
</tr>
<tr>
<td>Graduation and above</td>
<td>06</td>
<td>03</td>
<td>09</td>
</tr>
<tr>
<td>Tenurial Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owners</td>
<td>18</td>
<td>29</td>
<td>47</td>
</tr>
<tr>
<td>Owner-cum-tenants</td>
<td>25</td>
<td>11</td>
<td>36</td>
</tr>
<tr>
<td>Tenants</td>
<td>17</td>
<td>20</td>
<td>27</td>
</tr>
<tr>
<td>Family Size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4 members</td>
<td>07</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>5-6 members</td>
<td>21</td>
<td>40</td>
<td>41</td>
</tr>
<tr>
<td>7-8 members</td>
<td>20</td>
<td>26</td>
<td>33</td>
</tr>
<tr>
<td>9-10 members</td>
<td>08</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>&gt;10 members</td>
<td>04</td>
<td>04</td>
<td>06</td>
</tr>
<tr>
<td>Source: Field Survey</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Percentage is rounded to the nearest whole number.

The data also reveals that the average family size in the study area was 5-6 constituting 37% of the total sample size, followed by 7-8, and 9-10 with 30% and 16% respondents respectively. The family size of the sampled respondents of the two areas was more or less the same. These results show that the family size in the study area has declined from the national average of 6.80 members and provincial average 8.00 (rural NWFP) members per household (GOP, 1998). Among other factors one reason could be the increasing awareness about family planning practices and other birth control measures prevailing in the study area.

Composition and Pattern of Off-farm Employment

Off-farm employment of the sampled respondents was divided into three main groups i.e. part time employees in government/Private organizations, trade and commerce and daily paid labour. The farmers employed in the first category usually spend daily 5 to 6 hours in off-farm jobs; farmers of the other two categories are engaged in off-farm jobs on when their farm activities are off. The study results revealed that 70% of the sampled farmers were engaged in off-farm employment in both villages. The number of farmers in off-farm jobs was significantly high when compared to the study undertaken by Khan (2007) who observed that 25.33% of the farmers in valley Peshawar were engaged in off farm activities. However, unlike Khan (2007) this study was conducted only of small farms of district Nowshera, which may be an important reason for such large deviation in the off-farm employment.

The composition of off-farm employment in the study area is presented in the following table:

Table II Composition of off-farm occupation

<table>
<thead>
<tr>
<th>NATURE OF OCCUPATION</th>
<th>TOTAL</th>
<th>AKBARPURA</th>
<th>KURVI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Part time Employment</td>
<td>23</td>
<td>29.87</td>
<td>14</td>
</tr>
<tr>
<td>Trade &amp; Commerce</td>
<td>22</td>
<td>28.57</td>
<td>10</td>
</tr>
<tr>
<td>Daily paid Labour</td>
<td>32</td>
<td>41.56</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
<td>100</td>
<td>42</td>
</tr>
</tbody>
</table>

Source: Field Survey
The figures reveal that daily paid labour is the dominant off-farm activity. It may be because of the low level of education as well as the unavailability of other off-farm jobs. Engagement in trade and commerce was least because of lack of capital and skill to run a business. Thus the main occupation was provision of labour service for wage or salary. The pattern and composition of off-farm employment in the two areas is more or less the same. The main motive of off-farm jobs was to supplement the farm income and to diversify their income sources.

RESULTS AND DISCUSSION

Before getting final results the data was tested for the existence of multicollinearity, autocorrelation, and Heteroscedasticity (Annexure-A). Result of the model is presented in Table III.

Table III  Empirical results model-1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimated Coefficient</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 (Farm Holding)</td>
<td>-0.52330**</td>
<td>0.09507</td>
<td>0.000</td>
</tr>
<tr>
<td>X2 (Family Size)</td>
<td>0.29889**</td>
<td>0.08323</td>
<td>0.001</td>
</tr>
<tr>
<td>X3 (Farm Income)</td>
<td>-0.00017</td>
<td>0.00043</td>
<td>0.704</td>
</tr>
<tr>
<td>X4 (Farm Underemployment)</td>
<td>0.31514**</td>
<td>0.06852</td>
<td>0.000</td>
</tr>
<tr>
<td>X5 (Education)</td>
<td>0.10530**</td>
<td>0.02931</td>
<td>0.001</td>
</tr>
<tr>
<td>X6 (Age)</td>
<td>-0.01195</td>
<td>0.01190</td>
<td>0.318</td>
</tr>
<tr>
<td>X7 (Livestock)</td>
<td>0.07405</td>
<td>0.05818</td>
<td>0.206</td>
</tr>
<tr>
<td>X8 (Income from Other Sources)</td>
<td>-0.00075*</td>
<td>0.00039</td>
<td>0.058</td>
</tr>
<tr>
<td>Constant</td>
<td>2.7777*</td>
<td>0.9673</td>
<td>0.005</td>
</tr>
</tbody>
</table>

F = 99.259   R-Squared = 0.6453       R-Squared adjusted = 0.6173
Durbin-Watson = 2.1246  **Significant at 1%  * Significant at 5%

By looking into the results it seems that the model as a whole is statistically significant. Because F-statistic is significant and values of R$^2$ and R$^2$-adjusted are high for cross sectional data. Results of the individual variables show that X1 (Farm-Size), X3 (Income-from-Farm), X5 (Age), and X8 (Income-from-Other-Sources), are negatively related to Y (Off-farm employment) and the rest of the variables have a positive affect on the dependent variable. Variables X3 (Income-from-Farm), X5 (Age), X7 (Livestock) and X9 (Village effect) were insignificant. The only probable wrong sign was associated with the variable X7 (Livestock). A possible reason for such complications may be that the variable was irrelevant and the original model is over-fitted. This view gets strength as the said variable was insignificant, so we can claim that it was not relevant in our model. In order to improve the result of our model we should drop all irrelevant variables from the model. The above four insignificant variables were dropped from the model on the basis of the results of F test recommended by Gujarati (2004).

The insignificance of X7 i.e. livestock, is very much consistent with the findings of Khan (2007). A possible reason of the insignificance of livestock variable may be that women play an important role in rearing livestock, whereas, off-farm employment in this study shows employment of male farmers only. The insignificance of X7 i.e. income from farm output, may be justified on the ground that although off-farm is also done for supplementing farm income but farmers with large farm also divert their free time to off farm jobs. A possible reason for this is the high pay off in the off-farm jobs. However, the relationship of income from farm and off-farm employment is negative which means that farmers with reasonably large income from farm do less off-farm job.

The insignificant variables were dropped from the model after applying the F-test (Gujarati, 2004). After dropping these variables the model was re-analyzed and results of the modified model is given in the following Table IV.

Table IV  Empirical results of modified model

<table>
<thead>
<tr>
<th>Name of Variable</th>
<th>Estimated Coefficient</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 (Farm Holding)</td>
<td>-0.52407**</td>
<td>0.059960</td>
<td>0.000</td>
</tr>
<tr>
<td>X2 (Family Size)</td>
<td>0.30566**</td>
<td>0.067250</td>
<td>0.000</td>
</tr>
<tr>
<td>X3 (Farm Underemployment)</td>
<td>0.31881**</td>
<td>0.066001</td>
<td>0.000</td>
</tr>
<tr>
<td>X4 (Education)</td>
<td>0.11050**</td>
<td>0.028131</td>
<td>0.000</td>
</tr>
<tr>
<td>X5 (Income from Other Sources)</td>
<td>-0.00087*</td>
<td>0.000379</td>
<td>0.024</td>
</tr>
<tr>
<td>Constant</td>
<td>2.3779**</td>
<td>0.641800</td>
<td>0.000</td>
</tr>
</tbody>
</table>

F = 147.449   R-Squared = 0.6327       R-Squared adjusted = 0.6151
Durbin Watson = 2.0776  *Significant at 5% level  **Significant at 1% level
Results show that F-statistic is large and significant. Values of R² and R²-adjusted are very high for cross sectional data, which assumes that the model as a whole is statistically significant. The results of the rest of variables are interpreted and discussed below:

Farmers with large farm size do less off farm job and vice versa. These results are in accordance to the theory and findings of most of the research on this topic e.g. Khan (2007) observed negative sign for farm-size for Pakistan and Mecharla (2002) for India. Farmers with large families devote more time to off-farm job and vice versa. It is understandable that large families require more income to make their both ends meet. Since pay off on the farm is very small as compared to off farm jobs so people opt for off farm jobs. Besides that small and marginal farms cannot accommodate all family members. Usually the very old, very young, uneducated and unskilled are left on the farm whereas other members of the family migrate to other sectors of the economy.

Farm-Underemployment is positively related to off farm employment which means that greater the farm underemployment greater will be off-farm employment and vice versa. These results are consistent with the theory and findings on the topic e.g. Khan, (2007). Educated farmers tend to do more off-farm jobs as compared to the less educated farmers. It means that education enhances the level off-farm employment. These results are consistent with the findings of Mecharla (2002), Siphambe (2003), Bojnec and Dries (2005), Zahid (2006) and Khan (2007).

Income from other sources includes rental, pension, pay and wages of family members who are not engaged in farm activities. The major part of this income comes from the income remitted by the family members serving in other profession either in the same area, province or in other areas, provinces. The parameter of income from other sources is negatively correlated with off-farm employment, which means that greater the income from other sources lesser will a farmers’ devotion to off-farm employment. It gives strength to the idea that the main drive behind off-farm jobs is to supplement farm income to defeat poverty.

Off-farm employment of the two villages is estimated with equation 2. Results of the model are produced in the Table V below:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimated Coefficient</th>
<th>Standard Error</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 (Akarpura)</td>
<td>4.3033**</td>
<td>0.3277</td>
<td>0.000</td>
</tr>
<tr>
<td>D2 (Kurvi)</td>
<td>3.6440**</td>
<td>0.3590</td>
<td>0.000</td>
</tr>
</tbody>
</table>

F = 137.755  R-Squared = 0.0168  R-Squared adjusted = 0.0076  ** Significant at 01%

The highly significant value of F-statistic shows the overall significance of the model. The R-squared value is low, however, as Johnson et al. (1987) said, “In applied research settings, the R-square is a summary statistic, not a scoreboard.” The R-square value in the dummy variables multiple regression models are low because the main variables are not present in the model. The individual variables of the model are highly significant. Large value of the parameter of D1 indicates that the farmers of Akbarpura devote more time to off-farm employment than the farmers of Kurvi. Since the two dummy variables are highly significant this indicates that there exists significant difference in the Off-farm Employment of the two villages.

**CONCLUSION AND RECOMMENDATIONS**

Main determinants of off-farm employment in the sample villages were farm size, family-size, farm underemployment, farmers’ education, and income from other sources were. Family size, farm underemployment and education were positively related to off-farm employment; whereas farm size and income from other sources were negatively associated with off-farm employment. It was also established that the farmers of relatively developed and more accessible areas devote more time to off-farm employment as compared to the farmers of underdeveloped areas. This can be associated with the availability of jobs at local market and easy access to surrounding areas as well as better level of education. Most of the farmers sell their labour services for wage and salary because business is out of their reach due to lack of capital and skill.

On the basis of the finding the following recommendations are forwarded:

i. Infrastructure development, in particular construction and improvement of metallic roads in the rural areas, can serve like a double edge razor. It may serve as a farm to market road and will help farmers by providing easy access to urban market where they can get better price for their agricultural products. It will also help in augmenting farmer’s mobility to other areas in search of better off-farm jobs.
ii. Skill development programs should be introduced in rural areas to provide training and skills to the rural people in the village based agrarian professions like dairy farming, poultry farming, bee keeping, and handicraft activities etc.

iii. More funds for education facilities should be allocated in rural areas so that rural people gets easy access to education which may ultimately increase their efficiency. This will help farmers in getting well-paid off-farm employment and enhance their income through off-farm activities.

**Test for Multicollinearity**

For detecting Multicollinearity methods of Variance-Covariance Matrix, Correlation Matrix and Auxiliary Regression are commonly used. We applied the method of Correlation Matrix. According to this test each explanatory variables including constant is regressed on all other explanatory variables. If correlation coefficient thus computed is equal to or greater than 0.80 there exists Multicollinearity (Looms and Walsh, 1997). The results of the test are given in the following Table VI.

<table>
<thead>
<tr>
<th></th>
<th>X₁</th>
<th>X₂</th>
<th>X₃</th>
<th>X₄</th>
<th>X₅</th>
<th>X₆</th>
<th>X₇</th>
<th>X₈</th>
<th>Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>X₁</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₂</td>
<td>-0.5241</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₃</td>
<td>0.7413</td>
<td>0.5867</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₄</td>
<td>0.1040</td>
<td>0.1383</td>
<td>0.1574</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₅</td>
<td>0.0506</td>
<td>-0.1039</td>
<td>-0.1728</td>
<td>0.0480</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₆</td>
<td>-0.1066</td>
<td>0.0049</td>
<td>0.0391</td>
<td>0.1987</td>
<td>0.2256</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₇</td>
<td>-0.3333</td>
<td>0.1531</td>
<td>0.1362</td>
<td>0.1821</td>
<td>0.0151</td>
<td>0.2068</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₈</td>
<td>0.0819</td>
<td>-0.1728</td>
<td>0.1277</td>
<td>0.1215</td>
<td>-0.1088</td>
<td>-0.2056</td>
<td>0.0616</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.2322</td>
<td>-0.5816</td>
<td>-0.4582</td>
<td>-0.6140</td>
<td>-0.1505</td>
<td>-0.5763</td>
<td>-0.3691</td>
<td>-0.1221</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

The test results show that the values of the correlation coefficients of all explanatory variables are below the bench mark value i.e. 0.80, so we accept the hypothesis of no multicollinearity among the explanatory variables.

**Test for Heteroscedasticity**

Park, Covariance Matrix and Goldfeld-Quant tests are common methods available for detecting heteroscedasticity. Here we have applied Goldfeld-Quant test for detecting the problem of heteroscedasticity in our data.

**Goldfeld-Quant Test**

For conducting this test first some central observations are eliminated (termed as c), the remaining data is divided into two equal groups, regression of the two groups is separately run and the following ratio is compute:

\[ \lambda = \frac{\text{RSS}_2 \div \text{df}}{\text{RSS}_1 \div \text{df}} \]

If the assumption of Homoscedasticity is valid, then \( \lambda \) will follow F-distribution with numerator and denominator degree of freedom (df) each of \((n – c – 2k)/2\) (Gujrati, 2004).

In this analysis 30 central observations were eliminated, the data left were divided into two separate groups and regression of each group was separately carried. The above ratio was computed as under:

\[ \lambda = \frac{62.775 \div 34}{111.52 \div 34} \]

\[ \lambda = 0.5629 \]

The tabulated value of F is 2.20. By comparing the above ratio with the F-tab it is observed that the value of \( \lambda \) is not significant, so, we accept the existence of Homoscedasticity.

**Test for Autocorrelation**

The existence of Autocorrelation was tested with Durban-Watson (DW) test. It is calculated as follows statistic (Gujrati, 2004):
\[
\text{dw} = \frac{\sum_{t=n}^{t=n} (\hat{e}_t - \hat{e}_{t-1})^2}{\sum_{t=1}^{t=n} \hat{e}_t^2}
\]

where

\( \text{dw} \) Durban Watson statistic (calculated)

\( \hat{e}_t \) Estimated error term at time \( t \) and

\( \hat{e}_{t-1} \) Estimated error term at time \( t - 1 \) (preceding period)

In this particular problem the number of observations (\( n \)) are 110 and number of coefficients (excluding constant) are 8. The value of \( d_1 = 1.571 \). Value of \( d_u \) (tabulated \( \text{dw} \)) = 1.780 at 5% level of significance. On the basis of the above information we calculated the following zones:

<table>
<thead>
<tr>
<th>Negative Autocorrelation</th>
<th>Indecisive Zone</th>
<th>No Autocorrelation</th>
<th>Indecisive Zone</th>
<th>Positive Autocorrelation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( d_L = 1.571 )</td>
<td>( d_u = 1.780 )</td>
<td>( 4 - d_u = 2.22 )</td>
<td>( 4 - d_L = 2.429 )</td>
<td></td>
</tr>
</tbody>
</table>

The estimated \( \text{dw} \) ranges between 0 and 4. When the calculated value of \( \text{dw} \) (or \( d \)) is closer to 0, there are more chances of positive autocorrelation and if it is closer to 4 there is more plausibility of negative autocorrelation. When value of \( \text{dw} \) is equal to or closer to 2 suggests the plausibility of no autocorrelation. There are also inconclusive zones on both sides, in between 0 & 2 and 2 & 4 i.e. between \( d_L \) & \( d_u \) and \( 4 - d_u \) & \( 4 - d_L \) respectively.

The estimate \( \text{dw} \) value was 2.1246 which fall in the no-Autocorrelation area. Hence, this model is not plagued with the problem of autocorrelation. Thus, the hypothesis of serial independence in the residuals is accepted.

We can also verify these results with the help of runs test, also known as Geary Test. This is a non-parametric test, and suggests that expected number of runs be in between \( \{ E(k) \pm 1.96 \sigma_k \} \) with 95% confidence interval. The values of mean (\( E(k) \)) and variance (\( \sigma_k \)) are calculated as follows (Gujrati, 2002):

\[
E(k) = \frac{2n_1n_2}{n_1 + n_2} + 1
\]

\[
\sigma_k^2 = \frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}
\]

where

\( n_1 \) = number of positive residuals

\( n_2 \) = number of negative residuals

\( k \) = number of runs

The decision rule is that we don’t accept the null hypothesis of randomness with 95% confidence if

\[
[ E(k) - 1.96 \sigma_k \leq k \leq E(k) + 1.96 \sigma_k ]
\]

If the number of estimated runs (\( k \)) falls in between the two values, then we accept the randomness of residuals, and thus reject the existence of autocorrelation.

In this case, there are

\( k = 59 \)

\( n_1 = 56 \)

\( n_1 = 54 \)

so:\n
\[
E(k) = \frac{2(56)(54)}{56 + 54 + 1}
\]
\[ \sigma_k^2 = \frac{(2 \times 56 \times 54) \times (2 \times 56 \times 54) - 56 \times 54}{(56 + 54)^2 \times (56 + 54 - 1)} \]

\[ \sigma_k^2 = 27.2359 \]

\[ \sigma_n = 5.2188 \]

\[ \{ E(n) + 1.96 \sigma_n \} = 54.4865 \pm (1.96 \times 5.2182) \]

\[ = [64.7141, 44.2588] \]

The total number of runs in these calculations is 59, which lie in between the two values so we accept the hypothesis of randomness of residuals and thus reject the existence of autocorrelation.

**Results of Diagnostic Tests**

On the basis of the test applied it can be concluded that the model and data employed are free of the problems of Multicollinearity, Heteroscedasticity, and Autocorrelation. Thus the major assumptions of OLS are present and we can interpret the results with confidence.

**REFERENCES**


Bezemer, D.J. and J. Davis. 2003. The rural nonfarm economy in Romania: Overview of findings.


