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Impact of Rural-urban Migration on Household Income in Rural Bangladesh: An Application of 2-Stage NELM Model

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Abstract

Internal rural-urban migration plays a vital role in shaping life and livelihood for its stakeholders. This paper makes a rigor to evaluate the impact of migration on household income by applying a special type of econometric model, viz., New Economics for Labour Migration (NELM) model. The study used the primary dataset, generated by a nationally representative survey under National Food Policy Capacity Strengthening Programme (NFPCSP) of the Government of Bangladesh (GoB). The study extracted the necessary information from 1508 internal rural-urban migrant households and 746 non-migrant households from Rural-Urban Migration - 2012 (RUM-2012) survey data. The study has attempted to evaluate the impact of internal rural-urban migration on household income by applying 2-stage NELM models to avoid the estimation difficulties 3-stage models used by other researchers. The study has resorted instrumental variable regression technique to estimate the parameters of 2-stage NELM model to assess the impact of rural-urban migration on income of the origin households. The 2-stage NELM model-based analysis explores that rural to urban migration exerts negative impact, though insignificant, on on-farm income of the households. On the other hand, rural to urban migration are found to have significant positive impact on off-farm income of the households, might be due to the remittances sent by the migrants. The study recommends using 2-stage NELM model instead of 3-stage in evaluating the impact of such phenomena.

Keywords: Internal Migration, NELM Models, Food Security, Instrumental Variable Regression, On-farm Income, Off-farm Income, Migration Network.

AMS Classification: 91D10.

1. Introduction

Migration is one of the prioritized topics of research worldwide in different perspectives to explore interesting and remarkable phenomena regarding this issue. Migration, as always, is a complex characteristic of human being and is difficult to present in a certain structure. In recent years, the issue of migration has received special attention in many countries due to its impact. Researchers are using different tools and dimensions for exploring new phenomena regarding migration. The human migration behavior is very complex to explain, and therefore rigorous attempts are required for interpreting such complexity in order to get optimum benefit from it. The model-based analysis rather than descriptive statistical tools would help to interpret the complexity of migration. In Bangladesh, the rural-urban migration in Bangladesh dominates over other streams and make remarkable contribution to urban population growth. Due to lack of work opportunities in the rural areas, nearly two-fifths of rural households of Bangladesh are found to send their members in search of work opportunity in towns (Hossain, 2011; Skeldon, 2005). Using the panel data of 62 villages in Bangladesh, Rahman et al. (1996) estimated that nearly two-thirds migration occurred from rural to urban areas, while one-in-ten migration for rural-rural and nearly one-quarter movement occurred for international migration. The urbanization increased rapidly after independence in Bangladesh, and rural-urban migration has played the vital role for urban growth. It is documented that migration from rural to urban areas contributed between three-fifths to two-thirds of urban growth (UN, 1993). About 63% migration to the city was also estimated by Khun (2000) by analyzing the Demographic Surveillance System data of ICDDR,B for the period 1982-1996. The rural to rural migration in Bangladesh is more prevalent in coastal districts (Kar and Hossain, 2001). Afsar (2003) examined the patterns and trends of internal migration in Bangladesh along with the profile of migrants, labour markets conditions, key problems faced by migrants by using multiple datasets on the labour force and migration generated by the United Nations (UN), International Labour Organization (ILO) and the Bangladesh Bureau of Statistics (BBS). The study has documented that the

proportion of lifetime internal migrants increased sharply over time in Bangladesh. Hossain (2000) conducted an in-depth study on different aspects of rural-out migration in Bangladesh and documented that about half of the migrants migrated for temporary work opportunity and about one-quarter migrated for permanent work/job/service. It is also documented that the migration rate is higher for educated as well as unemployed people. Deshingkar (2006) investigated the nexus between internal migration, poverty, and development in Asia and claimed that internal migration has more potential for poverty reduction, achieving the Millennium Development Goals and contributing to overall economic growth in developing countries than does by international migration.

A number of empirical studies that dealt with the selectivity and determinants of migration, the majority were found to focus on consequences of migration (Afsar, 2003; de Haan, 2000; Hossain et al., 2013; 2016; Islam, 2003; Kainth, 2009; Mahapatro, 2009; Wintle, 1992). After a thorough review of the relevant literature of Asian countries on the links between rural-urban migration, food security and poverty reduction, (Hossain et al., 2013) has documented that the rural-urban migration produces both optimistic and pessimistic impacts at both origin and destination. The study has also focused on exploring the selectivity of internal rural-urban migration at both individual and household levels, exploring the food security effects of this type of migration. In addition to the socioeconomic impacts, migration also produces demographic impacts that include low fertility rate due to the physical separation between husband and wife (Sharma, 1992). In another study, Kainth (2009) argued that in addition to the economic factors, social, political, cultural, environmental, health-related and educational factors influence the internal migration.

Many researchers have also tried to assess the consequence and influence of migration on socio-economic condition of the associated households by application of both econometric and empirical models (Arif, 2006; Badaoui et al., 2013; Golgher, 2007; Hossain et al., 2013; Lall et al., 2006; Taylor et al., 2003). In a study, Arif (2006) investigated the impact of internal migration on household well-being measured through three indicators - per capita consumption, infant mortality and child malnutrition, and concluded that the migrant households were better off than the non-migrant households although the impact was not significant regarding these indicators. Golgher (2007) studied on selectivity of migration to investigate the associations of migration with rural poverty in Brazil using the

Human Capital Models framework. The study employed mathematical simulations and found that the influence of social nets, age and wages of low skilled and high skilled workers have impact on selectivity of migration. Lall et al. (2006) reviewed the internal migration policies in developing countries in the light of both economic theory (Dual economy models, Harris Todaro models) and empirical binary model to have in-depth understanding of the migration patterns and the welfare issues of internal migration. From some empirical literature, the study concluded that migration had a positive impact on individual and households from the economic sense and recommended to use the panel datasets for sufficiently understanding the migration process for future research. The impact of inward migration on local labour markets in Thailand has been investigated by Badaoui et al. (2013) through the data of Thai Labour Force Survey. The study used climate as an instrument variable for controlling possible endogeneity of internal migration and concluded that wages of low skilled male workers were highly flexible by the supply of migrant workers. However, the study found no significant effect on the wages of high skilled labourers and female labourers due to internal migration.

The review of the literature has identified that the impact of internal rural-urban migration on income and food security is extremely under-researched. In addition, NELM model-based instrument variables regression model analysis is barely found in the migration literature. Using a nationally representative survey of Bangladesh, Hossain et al. (2013) made a rigorous attempt to fill-up the knowledge gap regarding internal migration and its food security outcomes for sharpening policy makers understanding. The study has used perception analysis, instrumental variable regression and 3-stage NELM models to study the impact of internal rural-urban migration on food security. The results of the 3-stage NELM models indicated that rural-urban migration has a positive impact on both on-farm and off-farm income. However, some studies revealed that migration have negative impact on the on-farm income and positive impact on off-farm income (Taylor et al., 2003). A rigorous investigation is essential to verify this proposition. This study aims to verify this proposition by employing two-stage NELM model by excluding the equation for remittances of the 3-stage models of Hossain et al (2013), since the impact of remittances was found insignificant in the 3-stage model.

2. Materials and Methodology

2.1. Data Source

The data of this study is extracted from the data collected in the project "Rural-Urban Migration and its Implication for food security in Bangladesh" sponsored by Food and Agriculture Organization (FAO) and NFPCSP funded by GoB, United States Agency for International Development (USAID), and European Union (Hossain et al., 2013). This study has mainly utilized the data collected under origin-based household-level survey. The data have been collected from both migrant-households and non-migrant households (control group) under origin-based household-level survey. The project adopted cluster sampling methodology to select 60 rural clusters (primary sample units of Bangladesh Bureau of Statistics) considering two rural domains according to the East-West divide categorized by the World Bank in its poverty assessment study of Bangladesh (World Bank, 2008). Finally, the present study analyzed the information of 1508 migrant households (cases) and 746 non-migrant households (controls).

2.2. Model Specification

Hossain et al. (2013) performed two 3-Stage NELM models by considering two dependent variables viz., on-farm income and off-farm income considering number of migrants and amount of remittances as endogenous variables. In fitting the model with instrumental variable regression, the study has faced a serious problem to employ two sets of instruments simultaneously for the two endogenous variables (number of migrants and amount of remittances). To overcome the problem, the study estimated the predicted number of migrants using Poisson regression with count form and performed two-stage instrumental variable regression considering only the remittance as an endogenous variable. Having developed the models for on-farm and off-farm income with remittance as an endogenous variable and predicted number of migrants along with other covariates as exogenous variables, the test for endogeneity reveals that remittance is not appeared as the endogenous variable for both the models (Hossain et al., 2013). In this endeavor, the impact of internal migration on household income can be explored without considering the contribution of remittance and the present

study is designed to evaluate the impact of migration on household income ignoring the contribution of remittances in the model.

The basic equation of 3-stage NELM model proposed by Hossain et al. (2013) is expressed as

$$Y^{c}{}_{k} = \beta_{ok} + \beta_{1k}M + \beta_{2k}R + \beta_{3k}Z_{k} + \varepsilon_{k} \text{ ; where k = on-farm, off-farm} \quad (1)$$

$$R = \alpha_{o} + \alpha_{1}M + \alpha_{2}Z_{R} + \varepsilon_{R} \quad (2)$$

$$M = f(\beta; Z_{M}) + \varepsilon_{M} \quad (3)$$

where $f(\beta; Z_{M}) = \exp(\beta_{0} + \beta_{1}Z_{M}) + \varepsilon_{M}$, Y is the household income; M is the number of migrants; R is the amount of remittance; and Z is the vector of covariates containing of household characteristics.

Considering the insignificant effect of migration on remittance as found by Hossain et al. (2013) and make the simultaneous system of equations simple, this study has proposed to use 2-stage NELM model by excluding the remittance equation from the above system of equations. The proposed model can be expressed as

$$Y_{ik} = \beta_{ok} + \beta_{1k}Mig_{ik} + \beta_{2k}Z_{ik} + \varepsilon_{ik}; \quad (4)$$

In the above model, Y represents household income (where k = on-farm, off-farm); Mig_{i} represents the number of migrants; Z_{i} represents the vector of covariates comprising of relevant household characteristics. Hence, the study has proposed 2-stage NELM model to evaluate the impact of rural-urban migration on different types of household income, and the parameters of the models can be estimated by instrumental variables regression model. The study assumed the number of rural-urban migrants at household level as endogenous variable since migration may influence household income and reversely household income can cause rural-urban migration resulting dual causality.

2.3. Estimation of NELM Model using Instrumental Variable Regression

This study used the instrumental variable regression technique to estimate the parameters of 2-stage NELM models in order to study the impact of rural-urban

migration on household income. The instrumental variable regression is generally used when there exists an endogeneity problem in the main predictor variable, and literature suggests that internal rural-urban migration may create endogeneity issue (Hossain et al., 2013). Therefore, instrumental variable regression is the best possible way to study the impact of migration on household income. The mechanism of instrumental variable estimation includes finding a genuinely exogenous variable (instrument) that is strongly correlated with the potentially endogenous regressor and ensuring that the instrument only influences the dependent variable through the potentially endogenous independent variable. Once the instrument(s) are selected, it is essential to verify three issues: (i) validity of the instruments; (ii) strength of the instruments; and (iii) whether the suspected explanatory variable is indeed endogenous or not. Several tests are available in the literature to check the above conditions: the validity of instruments can be tested using Sargan $N*R^2$ test, Hansen J statistic and Basmann test; and the endogeneity issue can be tested using Wu-Hausman F-test and Durbin-Wu-Hausman χ^2 test.

The following two-stage least squares (2SLS) analysis is performed to estimate the parameters of equation (4) assuming endogeneity problem exists. The 2SLS regression has the advantage that it separates the movements of migration that are not correlated with error term, which forecasts past migration without any direct effect on the outcome variable (household income).

Stage 1: $$Mig_i = \alpha_o + \alpha_1 X_i + \alpha_2 Z_i + \varepsilon_k \quad (5)$$

Stage 2: $$Y_{ik} = \beta_{ok} + \beta_{1k} Mig_{ik}(hat) + \beta_{2k} Z_{ik} + \varepsilon_{ik} \quad (6)$$

In the above equations, X_i is a vector of instruments assumed to fulfil the requirements of instrumental exogeneity and relevance. In order to estimate the models jointly, it is essential to assume that (ε_i, ε_{ik}) follows independently and identically distributed MN(0, σ^2). In the estimation process, the model (5) estimates the coefficients associated with instrumental variable and covariates on migration (endogenous variable), with the aim to separate the problem-free component of the endogenous variable that is not correlated with the error term. The significance of the instruments is also needed to verify in the first-stage. In the 2nd stage, model (6) estimate the effects of migration variable on the household income by using this problem-free component. The key challenge to obtain the robust estimates of the above model is to find out an appropriate instrument for

the endogenous variable (migration). This study used both migration network (job informants as prior migration of the family or relatives) and share of male/female among adult active members (6-39 age groups) of the household as instruments. Several studies (Azzarri and Zezza, 2011; Karamba et al., 2011; Hossain et al., 2013; Taylor et al., 2003) suggests that these two variables act successfully as instruments to study the impact of migration on different aspects of food security outcome.

It is to be noted that the study considered on-farm income (revenue from agriculture like crop, fishery, dairy, poultry, nursery) and off-farm income (revenue from wages, business, pension, befits from safety nets programmes, other transfers including internal remittances) as dependent variables, and number of migrants at household level as endogenous variable. On the other hand, total cultivable land of household, education of the household head in terms of years of schooling, location of residence (east=0, west=1), status of main house (inferior quality=0, good quality=1), religion (Muslim=0, non-Muslims=1), gender of household head (female=1, male=0), distance from commercial/growth centre (in km), number of adult male members (labor force), rice purchasing status of the households (yes=0, no=1), NGO membership of the households (yes=1, no=0) are considered as independent or exogenous variables.

3. Result and Discussions

Migration exerts impacts on life and livelihood in several dimensions. Income and expenditure are two strong dimensions that are interwoven with human life. Income is linked to production and expenditure is linked to consumption and investment. Economic activities center round production and consumption and migration actually influences production and/or consumption in one or another way. Thus, migration may impacts on both income and expenditure through the economic activities of production and/or consumption and vice versa. This study makes an effort to uncover the impact of rural-urban migration on income at household level in rural origin resorting 2-stage NELM models. The results of the analysis is described in term of summary statistics and estimates of 2-stage NELM models.

3.1. Summary Statistics of the Study Variables

The summary statistics of the study variables according to the migration status is given in Table 1. The average amount of on-farm income has not been found significantly different on the basis of migration status of the households; however, the average amount of off-farm income has been found significantly ($p<0.01$) higher for migrant-sending households than for non-migrant households. The findings indicate that migrant-sending households possesses significantly ($p<0.01$) higher amount of cultivable land (107.48 decimals) than that of non-migrant households (83.28 decimals). The education level of the household heads has been found significantly ($p<0.01$) higher for the migrant households than their non-migrant counterpart. The percentage of households with good quality of houses has been found significantly ($p<0.05$) higher for migrant households in comparison to that of non-migrant households. Very rationally, the percentage of female-headed households has been observed higher for migrant households (7.4%) than their non-migrant counterparts (4.6%). The percentage of households having NGO membership was found significantly ($p<0.01$) higher among non-migrant households than migrant households.

Table 1: Summary values of the variables according to the migration status

Variables under study	Non-migrant households	Migrant households	Total
Dependent variables			
Average annual amount of on-farm income (in Taka)	46,735.35	53,722.69	51,411.1
Average annual amount of off-farm (in Taka)	89,375.23***	116,036.24***	10,7216.2
Endogenous Variables			
Number of internal rural-urban migrants per household	-	1.43	-
Independent/ Exogenous variables			
Average amount of cultivable land of household	83.28***	107.48***	99.5
Average years of schooling of the household head	4.25***	4.95***	4.7
Percentage of west regional households	49.61	50.19	50.0
Percentage of good quality house	72.7**	77.7**	76.0
Percentage of non-Muslims in the study population	10.30	11.00	10.8

Percentage of female headed household	4.60	7.40	6.5
Average distance from commercial centre (km)	22.03		
Average labour force of the study households	1.80	1.30	1.6
% of the households not to have purchased rice	29.00	31.90	30.9
% of households having NGO membership	38.20***	28.60***	31.8
Instrumental Variables			
% of households reported to having any sort of migration network	-	98.40	-
Share of male/female among adult active members (6-39 age groups) of the household	64.76***	91.87***	82.9

*** p<0.01; **p<0.05; *p<0.10

3.2. Estimates of the 2-stage NELM Models

For performing the analysis corresponding to equations (4) to (6), the study considered on-farm and off-farm income of the household as dependent variables to evaluate the impact of rural-urban migration on household income with the help of instrumental variable regression model. The vector of covariates (Z_i) consists of the variables – cultivable land of household, education of household head, location of residence based on east-west divide, status of living house, religion, gender of the household head, distance from commercial/growth centre, labor force of the households, rice purchasing status and NGO membership of the households. Considering the number of migrants as endogenous variable, two instrumental variables namely migration network and share of male/female among adult active members (6-39 age groups) at household level have been taken into account to estimate the parameters of the model with the endogeneity problems. The correlation analysis explores that both the instruments (migration network and share of male/female among adult active members (6-39 age groups)) have significant ($p<0.001$) correlation with the endogenous variable ($r=0.65, 0.20$) and insignificant weak correlation with the dependent variables ($r=0.035, 0.091; 0.104, 0.111$). In order to assess the impact of instrumental variables on endogenous variable (number of migrants), separate regression analyses have been

carried out first and the findings indicate that all the instruments have high F-value (F=1645.50 for migration network, F=95.97 for share of male/female in 16-39 age groups at household level). For assessing the effect of instrumental variables on endogenous variable, two distinct regression analyses have been performed and found that both the instruments have high F-value (1645.5 for migration network, and 96.0 for share of male/female among adult active members), indicating that instruments are valid for further analysis.

Table 2 shows the estimated coefficients along with necessary test statistics of 2-stage NELM model of different types of income at household level. The Sargan $N*R^2$ test indicates that both the instruments are strongly uncorrelated with the disturbance term for on-farm income model; however, it indicates a marginal rejection of the null hypothesis for model concerning off-farm income. At this step, second stage instrumental variable regression (IVReg-2) has been performed considering orthogonal options (STATA software), and the Hansen-J-Statistic admitted overcoming the over identification problem of the model. In order to obtain the robust estimates, the generalized method of moments (GMM) estimation technique of instrumental variable regression has been performed and the necessary test statistic recommends the goodness of fit of the models for both on-farm and off-farm income. It is to be noted that the significance level (p-value) of Wu-Hausman F test and Durbin-Wu-Hausman χ^2 test confirms the endogeneity of number of migrants for both the models.

The GMM estimates of the on-farm income model reveals that the number of migrants has insignificant ($p<0.39$) negative effect on on-farm income, may be due to minimum loss in farming due to labour depletion resulting from internal rural-urban migration. In the context of rural China, Taylor *et al.* (2003) found the significant negative impact on on-farm income. Among the covariates, cultivable land of the household, education of the household head, location of residence according to east-west divide and distance of household from commercial/growth centre were found to have significant positive impact on income from farming (Table 2). On the other hand, status of living house and religion were found to have highly significant negative impact on the income from farming.

On the other hand, the GMM estimates of the off-farm income model reveals that the number of migrants has highly significant ($p<0.0.01$) positive effect on the income from off-farm sources (Table 2). The plausible explanation is that in addition to the remittances from migration, labour loss due to migration cannot

affect the off-farm economic activities possibly for excessive labour force in the migrated households. The findings also indicate that total cultivable land of the household, education of the household head, status of living house, household labour force, NGO membership and proximity from commercial/growth centre have had significant positive impact on off-farm income. On the contrary, the findings indicate that location of residence and rice-purchasing status have had highly significant negative effect on off-farm income.

Table 2: Estimated coefficients along with necessary test statistics of 2-stage NELM model of different types of income at household level

Explanatory variables	**On-farm income**		**Off-farm income**		**Total income**	
	Coef.	P>z	Coef.	P>z	Coef.	P>z
Number of migrants	-2078.75	0.392	9048.59	0.013	5394.39	0.213
Total cultivable land of Household	380.97	0.000	56.68	0.075	430.15	0.000
Education of HH (Years of schooling)	1263.70	0.001	6045.45	0.000	7510.33	0.000
Location of residence (East=0, West=1)	14720.4	0.000	-42969.6	0.000	-29548	0.000
Status of living house (poor quality=0, Good quality=1)	-9203.97	0.030	25112.4	0.000	14255.8	0.019
Religion (Muslim=0, Non-Muslims=1)	-7932.81	0.045	1589.97	0.830	-7889.5	0.328
Gender of HH	2556.48	0.403	-10607.7	0.290	-6887.3	0.509
Distance to Commercial Area	224.39	0.005	301.19	0.004	549.14	0.000
Labor force of the household	2724.42	0.267	19957.7	0.000	24108.2	0.000
Rice purchasing status of the households (Yes=0, No=1)	34479.6	0.000	-20795.1	0.000	16409.1	0.024
NGO membership of the households (Yes=1, No=0)	477.93	0.866	20283.6	0.000	19803.8	0.000
Constant	-13073.3	0.045	37166.1	0.009	23669.4	0.122

No. of observations	2254	2254	2254
R^2	0.6395	0.5371	0.6988
F-test with P-value	67.58 (p<0.0001)	24.38(p<0.0001)	55.81(p<0.0001)
Tests of over identifying restrictions			
Sargan N*R^2 test Statistic	1.111	2.655	0.719
P-value	0.2919	0.1032	0.3964
Hansen-J-Statistic	0.825	1.970	0.598
P-value	0.3638	0.1604	0.4392
Test for endogeneity (H_o: Regressor is exogenous)			
Wu-Hausman F-test	3.42024	2.71906	0.17564
P-value	0.06453	0.09930	0.67519
Durbin-Wu-Hausman χ^2 test	3.43483	2.73152	0.17664
P-value	0.06384	0.09839	0.67427

4. Conclusion

The analysis indicates that 2-stage NELM models is sufficient to evaluate the impact of internal rural-urban migration on the household income at origin in Bangladesh, which reduces the estimation difficulties of using 3-stage models. The 2-stage model-based analysis extracts the findings regarding the impact of internal rural-urban migration on the household income at origin that rural to urban migration exerts negative impact, though insignificant, on on-farm income and significant positive impact on off-farm income. The researchers would be benefitted from the lessons of this study to choose the appropriate model. In addition, the concerned stakeholders and policymakers can take appropriate measure regarding the policies of internal rural-urban migration as the study clearly provided the message of the impact of such kind of migration on household income and food security.

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