Good Agricultural Practices, Farm Income, and Fertilizer Usage: Empirical Evidence from Smallholders in Nepal

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Introduction

- Agriculture is a crucial sector for Nepal's economy. The major crops grown are rice, maize, and wheat, which are also staple foods.
- Nepal exports agricultural commodities, accounting one-third of the total value of exports.
- Nepal's agricultural export competitiveness has declined in the recent past, one of the key reasons being the failure of farmers to adopt good agricultural practices (GAP)
- GAP is a set of production guidelines for producers that can help them produce safe and healthy food items and agricultural commodities (FAO, 2003).
- The Government of Nepal (GoN) in 2011 drafted its first national standard GAP for seven major exportable commodities (cardamom, citrus, coffee, ginger, honey, lentils, and tea). Recently, the GoN set policies in the Agriculture Development Strategy 2015-2035 to formulate standards for GAP that would be adopted for sustainable farming.

Objectives

- The specific objectives of this study are threefold:
  - to construct a GAP-Index, which measures the intensity of adoption of GAP;
  - to assess the impact of GAP (GAP-Index) on the farm income of smallholders; and
  - to assess the impact of GAP on fertilizer usage by those same smallholders.

Methods

To investigate the casual relationships between GAP-Indexes and farm income and fertilizer usage, we used the Two Stage Least Square (2SLS) and Tobit-IV regression models, respectively.

- Income model: 2SLS (equations 1-2)

$$y_i = x_i'\beta + \alpha G_i + u_i \quad (1)$$

$$G_i = z_i'\theta_1 + x_i'\theta_2 + v_i \quad (2)$$

- Fertilizer model: IV-Tobit (equations 3-4)

$$h_i^* = x_i'\delta + \gamma G_i + \eta_i \quad (3)$$

$$G_i = z_i'\rho 1 + x_i'\rho 2 + \xi_i \quad (4)$$

where, y = farm income (USD/ha); x = vector of explanatory variables; G = GAP-Indexes (either G^{PCA} or G^{MPM}); z = vector of instrumental variables; h^* = fertilizer usage (kg/ha), where $h_i = max(0, h_i^*)$; $h_i = 0$, if $h_i^* = 0$; $h_i = h_i^*$, if $h_i^* > 0$.

Data

- Data used for this study were from field surveys conducted in Nepal from Feb-Mar, 2015.
- Four major crop farmers, HYV paddy seed, lentil, tomato, and ginger smallholders, were selected from nine districts.
- A random sampling technique was used to select the smallholders in these districts. To conduct face-to-face interviews, a predesigned structured questionnaire was used.
- A total of 2,413 smallholders were interviewed, 2,411 of which were used in our econometric analysis.
- Farmers were queried on 45 qualitative questions related to GAP together with other questions.
- Using these 45 variables, we estimated the weights that were used to construct the GAP-Indexes, employing two methods, the principal component analysis (PCA) and the Markowitz (1959) portfolio method (MPM).

Results

Table 1: Impact of GAP adoption on fertilizer usage, result from IV-Tobit

Dependent variable, *ln h* = Log (fertilizer and manure in kg/ha)	Specification 1		Specification 2	
	Coefficient	SE	Coefficient	SE
GAP Index (PCA)	-3.756***	0.822		
GAP Index (MPM)			-5.85***	1.300
Gender (male = 1)	0.028	0.060	0.050	0.060
Education	0.059	0.061	0.082	0.063
Education^2	-0.007	0.007	-0.009	0.007
Family size (numbers)	0.029***	0.011	0.028***	0.010
Land owned	0.153***	0.040	0.132***	0.037
Ratio of revenue to cost	-0.166***	0.022	-0.192***	0.028
Contract (yes = 1)	0.310***	0.072	0.330***	0.074
Remittance (yes = 1)	0.202***	0.061	0.162**	0.061
Phone (yes = 1)	0.086	0.065	0.028	0.065
Manure (yes = 1)	0.445***	0.087	0.560***	0.082
Lentil (yes = 1)§	-5.123***	0.272	-5.000***	0.270
Ginger (yes = 1)‡	-2.207***	0.209	-2.935***	0.274
Tomato (yes = 1)§	1.501***	0.126	1.082***	0.146
Constant	5.760***	0.349	7.116***	0.637
Location effect	Yes		Yes	
Wald test for exogeneity††	15.90	[0]	13.02	[0]
Sample size	2411		2411	

- A 10 percentage point increase in the adoption of GAP decreases fertilizer and manure usage by 38-59%.

Results

Table 2: Impact of GAP adoption on farm income, results from IV-2SLS

Dependent variable, *ln y* = Log(income in USD/ha)	Specification 1		Specification 2	
	Coefficient	SE	Coefficient	SE
GAP-Index (PCA)	0.624**	0.266	-	-
GAP-Index (MPM)	-	-	0.850**	0.406
Gender (male=1)	-0.001	0.017	-0.006	0.017
Education	-0.070***	0.015	-0.071***	0.016
Education^2	0.006***	0.001	0.006***	0.002
Family size (numbers)	0.0003	0.003	0.001	0.003
Land owned	0.003	0.012	0.005	0.012
Ratio of revenue to cost	0.218***	0.008	0.221***	0.009
Contract (yes = 1)	0.124***	0.020	0.124***	0.021
Remittance (yes = 1)	0.061***	0.017	0.067***	0.017
Phone (yes = 1)	0.043***	0.017	0.052***	0.017
Lentil (yes = 1)	-0.651***	0.045	-0.651***	0.046
Ginger (yes = 1)	1.680***	0.067	1.735***	0.084
Tomato (yes = 1)	1.830***	0.050	1.900***	0.055
Constant	6.506***	0.104	6.321***	0.200
Location effect	Yes		Yes	
No. of instruments	3		3	
Endogeneity test (χ^2)	0.564	[0.453]	0.805	[0.370]
Test for instruments				
Relevance (F-statistic)	22.15	[0]	18.68	[0]
Test for instruments exogeneity	Yes		Yes	
Test for instruments redundancy	67.78	[0]	55.31	[0]
Sample size	2411		2411	

Instruments: farming experiences, membership in an organization, and market distance

- We find a positive and significant relationship between GAP-Indices and farm income.
- A 10 percentage point increase in the adoption of GAP increases farm income by between 6.2% and 8.5%.

Conclusion

- Through the use of qualitative variables, we first construct the GAP-Index, measures the intensity of adoption of GAP, and then assess its impact on farm income and fertilizer usage.
- The GAP-Indices estimated from the PCA and MPM methods are slightly different
- We find a positive and significant relationship between GAP-Index and farm income and a negative and significant relationship between GAP-Index and fertilizer usage, irrespective of GAP-Indices used.
- We conclude that a policy instrument (e.g. contract farming, a certification system) that encourages the adoption of GAP could have positive effects on both the income of smallholders and environmental and resource conservation.

References

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