APPENDICES: Tests of Model Specifications

The Wu-Hausman Test of exogeneity for the two models had significant F test, which confirmed that there was endogeneity in the model. In the Hausman specification test, a probability value of <0.05 suggests the acceptance of the null hypothesis of the efficient parameter.

Haven confirmed the need for an instrumental variable, and therefore the use of the 2LS, the validity of the instrument used was determined using the "Identification test" and the Test for weak Instrumentation". The test results, (Column 3, appendix 1) showed that for the two models, the instruments were exact.

In column 4, Appendix 1, the null hypothesis of weak instrument was tested for the instrumental variables used in each mode. For the output model, Legal land title was instrumented for, with Geopolitical Zones and Marital status. The F test was significant at 1%, suggesting that the instruments were strong enough. In Model 2,with Per capital food expenditure (measure of Food security) is the dependent variable, Legal land title and Farm yield were instrumented for using Geopolitical zones; and Types of Non legal title, respectively. In the two cases, the null hypothesis of weak instruments was rejected for all cases of the instrumental variables used in the models.

Appendix 1: Tests of hypothesis of Independence and Instrumentation.

	Endogeneity	**Overidentification**	**Weak instrumentation**
Production output	F: 73.69***	Chi2 (df: 5) 81.73***	F test: 10.72***
Food expenditure	F: 10.27***	chi2 : 65.17***	F test;91.22*** (Land title) F test; 30.04***(yield)

In the Hausman test to detect the efficiency of an OLS versus an instrumental variable (Appendices 2 and 3), the Prob > chi2 values for models 1 (Y=output) and 2 (Y=Food security) are 0.0088 and 0.0243, respectively, implying that the 2SLS IV model is consistent and therefore will provide unbiased estimators than if the OLS was used. Again, this confirmed that the use of the 2SLS was indeed required.

Appendix 2: Hausman Specification tests for model 1 (Dependent Variable= Output)

	(b) 2SLS	(B) OLS	(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
Legal land title	5.227778	0.056241	5.171538	1.06482
Age	-0.04448	-0.03773	-0.00675	0.019899
Age2	0.218926	0.183469	0.035457	0.12339
Sex (Ref: Female)	0.4244	0.683549	-0.25915	0.139493
Household size	0.018441	0.031769	-0.01333	0.011255
Land size	0.305078	0.305495	-0.00042	0.026614
Literacy: Ref: No	-0.32157	-0.16113	-0.16044	0.090246
Yield (log)	0.537468	0.449267	0.088201	0.031636
Irrigate (Ref: No)	0.013971	0.094927	-0.08096	0.221789
Tractor (Ref: No)	0.55505	0.652915	-0.09787	0.119936

b = Consistent under H0 and Ha; obtained from ivregress.
B = Inconsistent under Ha, efficient under H0; obtained from regress.
Test of H0: Difference in coefficients not systematic
chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 23.59
Prob > chi2 = 0.0088

Appendix 3: Hausman Specification test for Model 2 (Dependent Variable =Food expenditure)

	(b) 2SLS	(B) OLS	(b-B) Difference	sqrt(diag (V_b-V_B)) Std. err.
legit_land~e	0 .3592204	0.079101	0.28012	0.15194
lyield	0.2940412	0.056064	0.237978	0.057988
age	-0.0002375	0.001762	-0.002	0.000769
gender	-0.237449	-0.16267	-0.07478	0.03105
hhsize	-0.0914502	-0.095	0.00355	0.002406
landsize_ha	0.1214088	0.041141	0.080268	0.019648
literate	0.3133465	0.308828	0.004519	0.018755
credit	0.4112393	0.406998	0.004241	0.024209
urbrur	0.251509	0.342724	-0.09122	0.035179
irrigate	.0881955	0.156655	-0.06846	0.050776
tractor	.2913207	0.287416	0.003905	0.025777

b = Consistent under H0 and Ha; obtained from ivregress.
B = Inconsistent under Ha, efficient under H0; obtained from regress.
Test of H0: Difference in coefficients not systematic
chi2(11) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 22.00
Prob > chi2 = 0.0243
Reject Ho (B), accept 2SLS.