Poultry production and rural poverty among small-scale farmers in Mzimba District of Malawi

Assa, Maganga

University of Malawi, Bunda College

August 2012

Poultry production and rural poverty among small-scale farmers in Mzimba District of Malawi

Maganga M. Assa

Department of Agricultural and Applied Economics, Bunda College of Agriculture, P.O. Box 219, Lilongwe, Malawi
Tel: +265-111-208-804, Email: arthurmaganga@yahoo.com

Abstract

This paper evaluates the role of participating in poultry production on household income and rural poverty in Mzimba district, Malawi. The study utilizes cross-sectional farm level household data collected in 2011. The paper computes income-based poverty measures and investigates their sensitivity to the use of different poverty lines. Robust poverty comparisons across the poultry and non-poultry farmers reveal that poverty is in fact higher for the non-poultry compared to the poultry farmers. Thus, participating in poultry production has a significant positive impact on household income and poverty reduction.

Keywords: FGT, Poverty, Small-scale poultry production, stochastic dominance

Introduction

Poultry production is the fastest growing component of global meat production, with developing and transitional economies taking a leading role. In addition to providing opportunities to increase poultry exports, rising poultry production spurs growth in global import demand for feeds and other inputs and generates up- and downstream investment opportunities (Regmi 2001).

World poultry meat output increased nearly eightfold between 1961 and 2001, while the output in middle-income countries even rose more than twelve fold. In 1961, middle-income countries produced 34 percent of world poultry meat, high-income countries 61 percent, and low-income countries the remaining 5 percent. By the mid-1990s, middle-income country production had reached a level of 47 percent of the output of high-income countries. By 2001, middle-income countries accounted for the major share of world poultry production (52 percent) compared with 42 percent in high-income countries and less than 6 percent in low-income countries (Regmi 2001). However in Malawi, the trends in levels and growth of livestock per capita show that poultry production has been declining. The numbers of chickens per capita have been declining, with the average in the last past five years being lower than that recorded in the early 1970s. Despite this decline, agricultural policy documents specify several interventions to boost poultry production among small scale farmers in a conduit of poverty alleviation (ASWAP 2011).

The objective of poverty and malnutrition alleviation cannot be pinned down by a single peg. No single effort will achieve a major impact in isolation. However, poultry has shown to offer a practical and micro level step in alleviation of rural poverty. There is evidence that investments in small-scale poultry farming generate handsome returns and contribute to poverty reduction and increased food security in regions where a large share of the population keeps some poultry birds (Jensen and Dolberg 2003; Mack et al 2005; Pica-Ciamarra and Otte 2010). In Malawi, about 83% of rural households are estimated to keep flocks of 1 to 20 birds (Gondwe and Wollny 2002).

Although there is no universal definition of poverty, everyone seems to agree that it exists when one or more persons fail to attain a level of well-being deemed to constitute a reasonable minimum by the standards of that society (Ravallion 1993). This situation , which has been ascribed in some quarters to production failure owing to a suppression of markets and in some other quarters to distributional failure (Dasgupta 1998), is characterised by disease, low life expectancy, and physical and mental retardation. Therefore, for any effective plan to reduce poverty, the poverty dynamics of the population has to be understood.

Area specific empirical evidence on poverty dynamics among small scale farmers and how poultry production affects poverty is imperative for appropriate policy choices, program or reform management towards welfare shift in rural agrarian economy like Malawi. This evidence is brought on surface by estimating the dimensions of poverty among small scale farmers and determining the impact of poultry production on poverty among small scale farmers in Mzimba district.

Methodology

Study area and data

Data regarding various components of the small holder's poultry production were generated through a field survey study. The survey was conducted in the rural areas of Mzimba District of Northern part of Malawi during the month of May-June 2011. A semi-structure survey questionnaire was developed to collect information and a total of 89 farmers located in 8 villages were interviewed. The sample was distributed across 7 Agricultural Extension Planning Areas (EPAs). These EPAs were selected using simple random sampling. In the second stage, villages were selected using systematic sampling and finally in each village household were sampled proportionate to size sampling procedure. 67 of these households engaged in poultry farming with the remaining 22 did not engage in poultry farming. Both descriptive and quantitative analyses were carried out in the study. The descriptive analysis including means and percentage analysis were used to describe the socio-economic and demographic characteristics of farmers and their households in the study area.

Poverty analysis

To present the poverty profile of the farmers in the study area, various methods were used to estimate the extent and manifestations of poverty among the sample farmers. Specifically, the headcount, poverty incidence and poverty gap measures were employed in the analysis. Headcount measure estimates the absolute number of the poor in the sample. Poverty incidence estimates the percent of the poor in the total sample. Poverty gap measures the intensity of poverty based on the extent of income shortfalls below the poverty line by the poor in the sample (Olubanjo 1998). Specifically, the paper uses Foster-Greer-Thorbecke (FGT) which measures and subsumes the headcount index and the poverty gap, and provides the distributional sensitive measure through the choice of a poverty aversion parameter "α"; the larger the value of the "α", the greater the weight given by the index to the severity of poverty (Anyawu 1997). The general specification of the model is given below:

$$P_\alpha = \sum_{i=1}^{m} (1 - Y_i / x)^\alpha / N \qquad \text{for } \alpha = 0,1,2 \qquad (1)$$

Where, α is a non-negative parameter; Y_i is income per person in the ith household; q is the number of households below the poverty line; $x$is the poverty line value or threshold value of income; and N is the number of persons in the sampling population. α = 1 for poverty incidence, 2 for poverty depth and 3 for severity.

To compare poverty levels for poultry farmers and non-poultry farmers, it is worth to compare their income levels and check if distribution of income in one group always dominates the other. To implement this procedure, we use stochastic dominance algorithm. Stochastic dominance tests in poverty analysis checks whether the poverty ordering remains the same over a variety of poverty lines, based on the comparisons of cumulative distribution functions (CDF).

Consider two distributions of welfare indicators with cumulative distribution functions, F_A and F_B, with positive definite real numbers. Let

$$D_A^1(x) = F_A(x) = \int_0^x dF_A(y) \qquad (2)$$

If $D_A^1(x) \leq (<) D_B^1(x)$ for all income $x \in \Re_+$, A is a better distribution than B for any welfare function that is both increasing in the welfare variable (income). If we can say this for a broad range of poverty lines, then we have a quite general conclusion that A is preferable to B. Since $D_A^1(x)$ is also the poverty *headcount* ratio (P_0) where the x is the poverty line, it follows that first order dominance implies that poverty as measured by P_0 is lower for distribution A than for distribution B regardless of the poverty line chosen.

To define second-order dominance, let $D_A^2(x)$ be the area under F_A up to x

$$D_A^2(x) = \int_0^x D_A^1(y)dy \qquad (4)$$

If $D_A^2(x) \leq (<) D_B^2(x)$ for all x (i.e. the area under F_A up to x is less the area under F_B up to x), then distribution A is said to (strictly) second order dominate distribution B. Following Ravallion's (1994) terminology, if the "poverty deficit" curves (D^2) cross, then higher orders of dominance can be checked. In general terms, let $D_A^s(x) = \int_0^x D_A^{s-1}(y)dy$ for any integer, $s \geq 2$. Now distribution A is said to (strictly) dominate distribution B at order s if $D_A^s(x) \leq (<) D_B^s(x)$.

In the poverty dominance analysis literature, the graph of $D^1(x)$ is often referred to as the poverty incidence curve. This is the curve traced out as one plots the headcount index on the vertical axis and the poverty line on the horizontal axis, allowing the poverty line to vary from zero to an arbitrarily selected maximum poverty line. Similarly, the graph of $D^2(x)$ is usually regarded as the poverty deficit curve, which can be traced out by calculating the areas under the CDF (poverty incidence curve) and plotting its value against the poverty line. $D^3(x)$ is the poverty severity curve, the curve traced out by calculating the areas under the CDF (deficit curve) and plotting its value against the poverty line (Foster and Shorrocks 1988; Ravallion 1994).

Visual inspection of the difference in poverty measure curves for two groups that are very close to each other may suffer statistical backing in terms of the significance of their difference. To iron out such an assertion we follow Davidson and Duclos (2000) who presents estimator for $D^s(x)$. Thus the variance of the difference of the two estimators is,

$$\operatorname{var}(\hat{D}_A^s(x) - \hat{D}_B^s(x)) = \operatorname{var}(\hat{D}_A^s(x) + \hat{D}_B^s(x)) \qquad (5)$$

Simple t-statistics are constructed to test null hypothesis $Ho: \hat{D}_A^s(x) - \hat{D}_B^s(x) = 0$ for a series of test points up to an arbitrarily defined highest reasonable poverty line. In cases where the null hypothesis is rejected and the signs are the same on all of the *t* statistics, then dominance of order *s* is declared.

Econometric construct

To measure the effect of poultry production on poverty, an endogenous switching regression was employed which is able to take care of selection biases. We specify the selection equation for poultry production as

$$G_i^* = \beta X_i + u_i \quad \text{with} \quad G_i = \begin{cases} 1 & \text{if} \quad G_i^* > 1 \\ 0 & \text{otherwise} \end{cases} \qquad (6)$$

Where, G_i* is the unobservable or latent variable for technology adoption, G_i is its observable counterpart (the dependent variable participation in poultry production equals one, if the farmer adopts and zero otherwise), X_i are non-stochastic vectors of observed farm and non-farm characteristics determining participation and u_i is random disturbance associated with the participation in poultry production and and β is a vector of parameters to be estimated..

Participation in poultry production by a farmer is assumed to be derived from the maximization of a discounted expected utility of benefits subject to farmer specific characteristics. We hypothesise that a vector of household specific variables influence the choice of participation.

To account for selection biases we adopt an endogenous switching regression model of welfare outcomes, (i.e. household income) where farmers face two regimes (1) to participate, and (2) not to participate defined as follows:

Regime 1: $Y_{1i} = \alpha J_{1i} + e_{1i}$ **if** $G_i = 1$ (7)

Regime 2: $Y_{1i} = \alpha_2 J_{2i} + e_{2i}$ **if** $G_i = 0$ (8)

Where Y_i is household income in regimes 1 and 2, J_i represents a vector of exogenous variables thought to influence household income. The error terms in Eq. (6), conditional on the sample selection criterion, have non-zero expected values (Lee 1978; Maddala 1983). Lee (1978) treats sample selection as a missing-variable problem.

The error terms are assumed to have a tri-variate normal distribution with zero mean and non-singular covariance matrix specified as;

$$\operatorname{cov}(\varepsilon_{1i}, \varepsilon_{2i}, \varepsilon_i) = \begin{pmatrix} \sigma_{e2}^2 & . & \sigma_{e2u} \\ . & \sigma_{e1}^2 & \sigma_{e1u} \\ . & . & \sigma_u^2 \end{pmatrix} \qquad (9)$$

Where σ_u^2 is the variance of the error term in the selection equation (6), (which can be assumed to be equal to 1 since the coefficients are estimable only up to a scale factor), σ_{e1}^2 and σ_{e2}^2 are the variances of the error terms in the welfare outcome functions (7) and (8), and σ_{e1u} and σ_{e2u} represent the covariance of u_i, e_{1i} and e_{i2}. Since Y_{1i} and Y_{2i} are not observed concurrently the covariance between e_{1i} and e_{2i} is not defined (Maddala 1983).

Full information maximum likelihood (FIML) estimation provides an efficient method to estimate endogenous switching regression models (Lee and Trost, 1978; Lokshin and Sajaia 2004). Given the assumption of trivariate normal distribution for the error terms, the logarithmic likelihood function for the system of equations (6) and (7 and 8) can be given as

$$LnL = \sum_{i=1}^{N} G_i \left[\ln \varphi\left(\frac{e_{1i}}{\sigma_{e1}}\right) - \ln \sigma_{e1} + \ln \Phi(\phi_{1i}) \right] + (1 - G_i) \left[\ln \varphi\left(\frac{e_{2i}}{\sigma_{e2}}\right) - \ln \sigma_{e2} + \ln(1 - \Phi(\phi_{2i})) \right] \qquad (10)$$

Where $\phi_{ji} = \dfrac{(\beta X_i + \gamma_j e_{ji} / \sigma_j)}{\sqrt{1 - \gamma_j^2}}$, J_i= 1,2 with σ_j denoting the correlation coefficient between the error term u_i of the selection equation (6) and the error term e_{ij} of equation (7) and (8), respectively. The FIML estimates of the parameters of the endogenous switching regression model can be obtained using the *movestay* command in STATA (Lokshin and Sajaia 2004).

Empirical findings and discussion

Socio-demographic characteristics of sample farmers in Mzimba district are presented in Table 1. Analysis has revealed that majority of households (64%) are headed by males while 36% are female headed. Average age (49years) of farmers did not differ between poultry and non poultry farmers. Distribution of respondents with respect to educational status reveals that 97% of them attained different levels of formal education. An average household earn MK 126,516 for poultry farmers and 12,978 for non poultry farmers. . Frequency of extension visits, membership to farmer organization, livestock training and access to credit were most common among poultry farmers than non poultry farmers (Table 1). There are more farmers who are aware of climate change among poultry farmers. Probably this could be one of the reasons they engage in poultry production as they know that poultry may provide an avenue for escaping climate change impacts. The results reveal that family sizes are larger among adopter than non adopters.

The housing conditions of a household provide good indicator of welfare measurement. Among poultry farmers, about 69% of farmers live in grass thatched houses and only 31% live in houses with iron sheets. About 84% lived in housed constructed from burnt bricks with 16% in mud houses. Among non poultry farmers, about 57% of farmers live in grass thatched houses and only 43% live in houses with iron sheets. About 78% lived in housed constructed from burnt bricks with 22% in mud houses.

Table 1: Definition of variables and descriptive statistics

Variable	**Units**	**Poultry farmers**	**Non poultry farmers**
Age	Years	49	49
Land size	Hectares	1.61	2.08
Household income	MK	126,516	12,978
Extension visit	1 =yes	0.15	0.06
Membership to organization	1=yes	0.75	0.67
Access to livestock information	1=yes	0.92	0.80
Livestock training	1=yes	0.18	0
Household size	No of persons	5.4	4.6
Credit status	1=access to credit	0.19	0.32
Distance to main market	Km	11	17
Gender of household head	1= Male	0.25	0.32
Average price of chicken **(buy/sell)**	MK	800	838
Household size	No of persons	5	3
Climate change awareness	1=yes	0.61	0.5
Knowledge of poultry drug	1=yes	0.54	0.13
		Frequency	
Education	lower primary	10%	22%
	upper primary	46%	33%
	junior secondary	16%	27%
	senior secondary	22%	11%
	tertiary	1.4%	-
	None	2%	5%
Housing condition	Grass thatched	69%	57%
	Iron sheet	31%	43%
	Mud	16%	21%
	Burnt bricks	84%	78%

As shown on Table 2, poverty incidence among small scale farming families was found to be 64% resulting from 60% of household involved in poultry production and 85% of household without poultry. This implies that, overly, 60% of the respondent farmers and 85% of non poultry farmers were actually poor. This proportion invariably represents the poverty incidence among the sample. Those who are involved in poultry production reported lower than 77% as at 2002 reported by Chirwa (2005).

The poverty-gap index (PG), defined by the mean distance below the poverty line as a proportion of that line, is usually interpreted as a measure of poverty depth. The poverty gap of the sample was 42%. The figure was 38% for poultry farmers and 56% for non-poultry farmers. This implies that poor poultry farmers required 38% and non-poultry farmers required 56% of the poverty line to get out of poverty.

Table 2: Foster-Greer-Thorbecke (FGT) class of poverty measures for the study sample

FGT Measures	Poultry farmers	Non-poultry farmers	Pooled
Incidence of poverty	0.60	0.85	0.64
Depth of poverty	0.38	0.56	0.42
Severity of poverty	0.30	0.42	0.33

Computed from 2011 study data

Finally, overall severity of poverty computed by FGT was 33%. This measure implies that a distinction is made between the poor and the poorest. This follows since the poverty depth is not sensitive to re-distribution among the poor. The assumption with the poverty gap is that a Kwacha gained by the poor would have the same effect on poverty as that gained by the moderately poor farmers. As such, to capture the sensitivity to income re-distribution among the poor and non-poor, there exists the need to estimate the severity of poverty among the study sample. There was a difference between poverty severity of poultry farmers (30%) and non-poultry farmers (42%).

The stochastic dominance tests show a similar result. The test statistics are calculated at each value of the poverty line, where we only considered 20 poverty lines between MK676 and MK3800 per capita per year. The estimated headcount ratios along with the *t*-statistics of the difference $\hat{D}_A^s(x) - \hat{D}_B^s(x)$ for each of 20 points were obtained. Figures 1 shows the poverty incidence curve. A close inspection of the poverty incidence curve (Figure 1) reveals that there is first-order dominance because the CDF of adopters is always to the right of non-adopters but results of the test statistic for each value is insignificant indicating there is no first-order dominance. Given that first order dominance is observed, it left no desire to test for higher order dominances.

That is, poverty as measured by head count index is unambiguously lower for poultry farmers than for those who do not engage in poultry farming, regardless of the poverty line chosen. This result underscores the role of livestock in contributing to poverty reduction through increasing per capita household income. This suggests that the poultry production had a measurable impact on reducing the incidence of poverty.

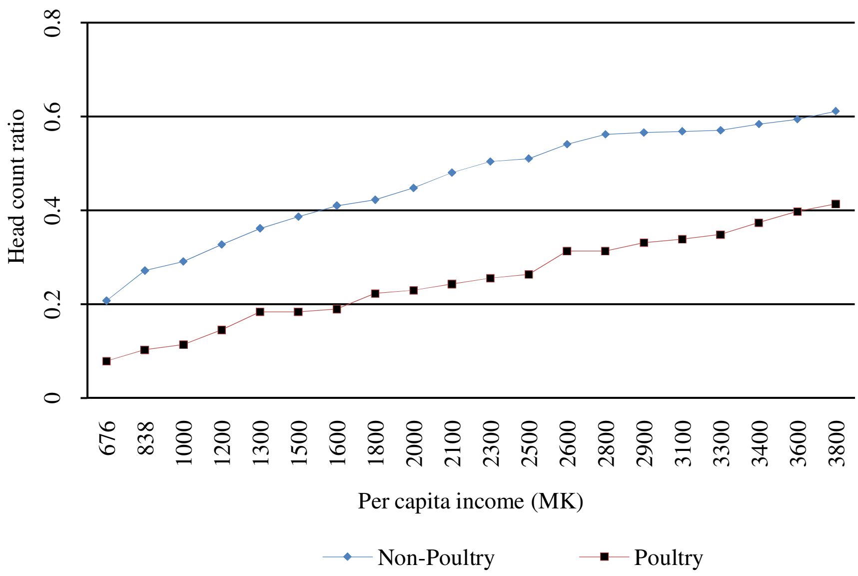

Figure 1. Poverty incidence curves

The full information maximum likelihood estimates of the endogenous switching regression model that can control for unobservable selection bias are reported in Table 2 and adoption of poultry production in Mzimba. The first column presents the estimated coefficients of selection equation (2) on adopting poultry production or not whereas the second and third column presents the household incomes functions for adopters and non adopters.

The Full Information Maximum Likelihood estimates of the endogenous switching regression model of household welfare are presented in Table 2. The last but one row gives the estimates of the coefficients of correlation between the random errors in the system of equations. The estimated coefficient of correlation between the adoption equation and the adopters' welfare function ϕ_1 is positive and significant. The adoption model results and the switching regression model results together suggest that both observed and unobserved factors influence the decision to adopt poultry production and dynamics of their welfare given the adoption decision. The significance of the coefficient of correlation between the adoption equation and the welfare function for adopters indicates that self-selection occurred in the adoption of poultry production. That is, (1) poultry production had a significant impact on household welfare among adopters; and (2) adopters would have got greater benefits from improved cowpea varieties than non-adopters, had non-adopters chosen to adopt. However, the estimated coefficient of correlation between the adoption equation and the non-adopters' welfare function, ϕ_2, is not significantly different from zero, implying that adopters and non-adopters operate on same indifference curve in absence of poultry production, given their observed characteristics. The initial differences between adopters and non-adopters, though insignificant, brought about differential effects of poultry production on the two groups, confirming the sensitivity of poultry impacts to initial differences due to unobserved factors.

Table 2. Full information maximum likelihood estimates of the switching regression model
Dependent variable: Poultry production and household annual income for Mzimba, Malawi

Variables	FIML Endogenous Switching Regression		
	Poultry participation (1/0)	**Participation =1** poultry farmers	**Participation =0** Non poultry farmers
Age of household head	0.01 (0.002)***	0.54 (0.33)	0.58 (0.35)*
Gender of household head	0.62 (0.52)	1.73 (0.70)**	0.17 (0.35)
Lower primary (std 1 - 4)	0.24(0.14)*	0.15(0.13)	0.16 (0.07)**
Upper primary (std 5 - 8)	0.03(0.34)	-0.32(0.6)	0.13 (0.05)**
Junior secondary (form 1 - 2)	-0.42 (0.18)**	0.13(0.08)*	1.32 (1.13)
Senior secondary (form 3 - 4)	-0.5 (0.21)**	-0.01 (0.04)	0.61 (5.11)
Tertiary, diploma	0.67 (0.52)	-0.001 (0.003)	0.05 (0.14)
Had livestock extension services	0.25 (0.17)	0.01(0.003)***	2.33 (4.65)
Total Land size	0.42 (0.18)**	1.48 (0.41)***	0.88 (0.05)***
Average price of chicken (buy/sell)	-0.002 (0.002)	-1.89 (0.54)***	0.66 (0.26)**
Household size	0.26 (0.43)	0.02 (0.05)	0.43 (0.17)**
Access to market information	-0.67 (0.27)**	-0.72(0.53)	-1.99 (2.13)
Climate change awareness	0.02 (0.01)***		
Access to credit	64.8 (92.3)		
Log of distance to the market	1.12 (0.27)***		
Member to farmer organization	0.18 (0.06)***		
Knowledge of poultry drug	0.39 (0.14)***		
Intercept	2.02 (0.65)***	1.09(0.08)***	6.53 (11.6)
LR test of independence of equations (χ^2)	583***		
Wald χ^2 (12)	238***		
σ_{ei}		0.89 (0.06)***	0.892 (0.06)***
ϕ_j		0.63 (0.14)***	-0.21 (0.44)

*,** and *** mean significant at 10%, 5% and 1%, respectively
Figures in parenthesis are std. errors.

Conclusion and policy implication

The paper has examined the role of small-holder poultry production as a tool for poverty reduction among farmers in Mzimba district, Malawi. The following conclusion can be drawn from the study: Backyard poultry production make an important contribution to poverty alleviation/mitigation and should be considered in any strategy aimed at improving rural livelihoods. With the right policies and investment, there is ample evidence that well designed and participative development programmes that enhance livestock (poultry) production can overcome poverty and enhance significant economic and social benefits among rural population.

References

Anyawu JD 1997 Poverty in Nigeria: Concepts, Measurements and Determinants. In: Obaseki, PJ (Eds.), Poverty Alleviation in Nigeria. Proceedings of Nigeria Economic Society Annual Conference.

Chirwa EW 2005 Macroeconomic Policies and Poverty Reduction in Malawi: Can we Infer from Panel Data. GDN.

Dasgupta P 1998 The economics of poverty in poor countries. Scandinavian Journal of Economics 100(1): 41-68.

Davidson R Duclos JY 2000 Statistical inference for stochastic dominance and for the measurement of poverty and inequality. Econometrica **68(6),** 1435–1464.

Foster JE and Shorrocks AF 1988 Inequality and poverty orderings. European Economic Review. 32(2-3), 654–661

Gondwe TNP and Wollny C 2002 Challenges to Organic Farming and Sustainable Land Use in the Tropics and Subtropics. State of Poultry Production and Breeding in Malawi. Deutscher Tropentag Witzenhausen, October 9-11,

Jensen HA and Dolberg F 2003 A Conceptual Tool for Using Poultry as a Tool in Poverty Alleviation. Revised version. Paper delivered at the International Conference on Staying Poor: Chronic Poverty and Development Policy, IDPM, University of Manchester.

Lee LF and Trost RP 1978 Estimation of some limited dependent variable models with application to housing demand. Journal of Econometrics 8: 357-382.

Lokshin M and Sajaia Z 2004 Maximum Likelihood Estimation of Endogenous Switching Regression Models. Stata Journal 4(3): 282-289.

Mack SD Hoffmann and J Otte 2005 The Contribution of Poultry to Rural Development. World's Poultry Science Journal, 61(1): 7–14.

Maddala GS 1983 Limited dependent and qualitative variables in econometrics. Cambridge, U.K.: Cambridge University Press.

Olubanjo OO 1998 Profile of the poor and poverty alleviation in the countryside: The case of four spatial settlements in Ogun State, Nigeria, The Nigerian Rural Sociologist 2(1): 31-40.

Pica Ciamarra U and Otte J 2010 Poultry, Food Security and Poverty in India: Looking beyond the Farm-gate. World's Poultry Science Journal, 66(2): 309–320.

Ravallion M 1993 Poverty comparisons. Fundamentals in pure and applied economics, Vol. 56. Chur, Switzerland: Harwood Academic Press.

Ravallion M 1994 Poverty Comparisons. Harwood Academic Press, Chur, Switzerland

Regmi A (Ed) 2001 Changing Structure of Global Food Consumption and Trade [Online]. Washington DC [USA]. Economic Research Service/USDA. Pp 103-107. http://www.ers.usda.gov/publications/wrs011/ Accessed 2012 July 24.