Market and Other Factors Affecting Farm-Specific Production Efficiency in Poultry Production in Vietnam

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ABSTRACT. Stochastic frontier production function was used to assess technical efficiency and its determinants for a stratified sample of 1118 poultry farms in Vietnam for which data were collected in 1999. In general there are significant differences in the production behaviour and efficiency level between the North and the South, among farms producing different breeds of poultry, between mixed and specialized poultry farms, between household and commercial farms, and among producers located in different agro-ecological regions. Sale at market place rather than at farm gate, market distance and flock size significantly reduced inefficiency in both the regions. Contract farming or sale, number of visits by extension staff, family labor supply, land size and education of household had significantly reduced inefficiency in the North but had no

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significant effect in the South. The direction and significance of influence on efficiency differ between the two regions for credit use, inputs from government, ratio of home produced of crude feed, producer age and gender of household head. Therefore, opportunities exist for improving average efficiency through interventions in a number of product and input market domains and household characteristics that may improve access to information, technology and management decisions.

KEYWORDS. Production efficiency, frontier function, poultry, Vietnam

INTRODUCTION

The government of Vietnam has recently adopted an agricultural diversification programme in which development of the livestock sector has been given substantial priority as a slowdown in rice production, the main rural economic enterprise, in recent years has indicated the limited prospect for growth through rice alone. However, two questions are pertinent to make the diversification strategy through livestock work effectively. First, with increased economic liberalization and opening of the domestic market to competition, whether livestock production will remain sufficiently efficient and competitive with the outside world in order to play a significant role in rural income diversification. Second, whether smallholders, who currently dominate the sector, will remain efficient and competitive to stay in business to reap the benefits from rapidly growing for livestock products.

A recent analysis of pig and poultry production in Vietnam using policy analysis matrix (PAM) showed that poultry meat and egg production is generally competitive except meat and egg production with local breeds, and egg production with crossbreeds in the North, and egg production with local breeds in the South, due to low productivity and high per unit cost. Pig production under existing technologies and market conditions is highly competitive, especially with local and crossbreeds in the North and exotic breeds in the South. Currently the producers in the South are apparently benefiting more due to market conditions and policy that make input cost higher and output price lower in the North.

Since PAM results are basically based on the performance of the average farm, in reality differences in technical and economic efficiency may vary widely across individual farms and this may also vary for different breeds. Thus, at the individual farm level, the ability to compete within a liberalized economic environment may vary widely–some may be highly competitive while others may not be so. The study, therefore, recommended that a detailed farm-specific efficiency analysis might shed more light on the production and profit frontiers of poultry and pig farms in the country (Akter et al., 2004).

Following this recommendation, farm specific technical efficiency and its determinants, especially market related factors, have been analyzed for poultry production. Poultry is raised throughout Vietnam as an important component of all types of farms, and large-scale commercial production is a more recent phenomenon. Also local, cross, and exotic breeds are raised. So efficiency in poultry production has implications for producer and consumer welfare in the country. In section 2, methodology and data are described, in section 3 the results are discussed with conclusions at the end.

METHODOLOGY AND DATA

Analytical Framework

The stochastic frontier production function approach was used for efficiency measurement in this study. Theoretical and empirical literature on this approach is quite extensive. In short, the stochastic frontier approach incorporates a composed error structure with a one-sided inefficiency component and a two-sided symmetric random component. The inefficiency component is used to obtain firm specific or average efficiency and the random component picks up the effect of uncontrolled random shocks, such as weather, measurement error, disease, and other statistical noise. There are many variants in model specification and distribution of the unknown variance of the inefficiency component (Aigner et al., 1977; Meeusen and Van Den Broeck, 1977; Jondrow et al., 1982; Battese and Coelli, 1988).

In this study, a modified Cobb-Douglas specification was assumed and the following frontier production and inefficiency models that are variants of Coelli and Battese (1996) were specified:

$$\ln(Y_i) = \alpha_0 + \Sigma\beta_j \ln(X_{ij}) + \Sigma\alpha_j D_j + v_i - u_i \quad (1)$$

$$\mu_i = \delta_0 + \Sigma\delta_k Z_{ik} \quad (2)$$

where the subscripts i, j, k and p refer to the i-th farmer, the jth and the kth parameter or variable respectively (i = 1 . . . n, j = 1 . . . J, k = 1 . . . K); ln represents the natural logarithm; Y, X, and Z are variables to be defined below.

The α_0,β_j, α_j,δ_0 and δ_k are unknown parameters to be estimated; the v_{is} are assumed to be independently and identically distributed random errors with distribution $N(0, \sigma_v^2)$; the u_{is} are non-negative technical inefficiency effects independently distributed and arise by truncation at zero of the normal distribution $N(\mu_i, \sigma_u^2)$, where the unknown variance σ_u^2 is defined by:

$$\sigma^2 = \sigma_u^2 + \sigma_v^2 \quad (3)$$

$$\gamma = \sigma_u^2/\sigma^2 \quad (4)$$

and the mean μ_i is defined by equation (5) below[1]. The value of the parameter ã lies between zero and one. When the frontier production function is defined for the logarithm of production, then the suggested measure of technical efficiency for the ith farm is:

$$TE = \exp(-u_i) \quad (5)$$

Thus, given the specification of the stochastic frontier model (1) and (2), the technical efficiency of the ith farm can be obtained by using equation (5) (Battese and Coelli, 1993).

In addition to measuring the level of efficiency, differences in efficiency levels and their causes are also explained. Empirical studies to explain differences in efficiency of farms used either a two-stage or a single-stage approach. In the two-stage approach, the first stage involves the estimation of a stochastic frontier function and the prediction of farm specific technical inefficiency or efficiency effects. The second stage estimates the effects of the factors explaining technical efficiency using ordinary least squares regression. This approach is criticised on the ground that the assumption of independent and identical distribution of the inefficiency effects is violated in the second stage when they are made to be a function of the farm specific factors (Kumbhakar et al.,

1991; Reifschneider and Stevenson, 1991; Kumbhakar and Lovell, 2000). The single-stage approach specifies stochastic frontiers and models for the technical inefficiency effects and simultaneously estimates all the parameters involved. We apply this one-stage approach because it leads to more efficient inference with respect to the parameters involved (Coelli and Battese, 1996). Frontier version 4.1 software was used to analyse the data (Coelli, 1994).

Source of Data and Definition of Variables

The data set consisted of a nationwide stratified sample survey of 1,118 poultry farms. Region (north and south), farm size (small, medium, large) and breed (local, crossbred and exotic) were used as stratification criteria for sampling farms. Data were collected during August 1999 to January 2000 through a single visit survey using detailed questionnaire. Trained Vietnamese field staff conducted the survey (for details see, IFPRI, 2001). Separate analyses were done for the North and the South regions.

Variables included in the empirical estimation of equations 1 and 2 and their average values for North and south Vietnam are shown in Table 1. The X variables are in the production function and the Z variables are in the inefficiency function. Explanation on the definition of some variables and hypotheses about their expected influence are given below.

Most important inputs in poultry production are stocks, labour, and feed. The feed inputs consist of various crude materials and fodder crops (purchased from the market and produced at home) and concentrate feed. Crude materials and fodder crops are of lower quality than concentrates. In order to capture the effects of feed quality on productivity, the ratio of crude materials and fodder crops to total feeds is used as a separate variable.

The dummy variables for farm types are of particular interest. Commercial farms are expected to be on the higher production frontier than the household farms. Producers of improved breeds are expected to be on the higher production frontier than the producers of local breeds. The producers who are specialized in poultry production are expected to be on the higher production frontier than the producers who simultaneously produce a number of different types of livestock. Productivity may also differ according to agro-climatic variations depicted by the agro-ecological dummy variables in each regional equation. Use of product type (egg vs. meat) as a dummy did not improve model fit,

TABLE 1. Description of Variables Included in the Stochastic Frontier Function for Poultry Production, Vietnam, 1999

Variable	Description of the variable	Average values	
		North	South
Output (Y)	Value of output plus change in inventories (000'D per farm)	26370	116297
Stock (X1)	Value of stocks (000'D per farm)	7590	20638
Labor use (X2)	Annual labor (person days) spent for production	100	265
Feed (X3)	Total feed (kilogram per household)	3365	17980
Crude feed ratio (X4)	Ratio of crude materials and fodder crops to total feed (%)	80	50
Housing (X5)	Housing area (sq. meter per household)	51	411
Veterinary cost (X6)	Annual cost on veterinary fees and drugs (000'D per farm)	437	8625
Farm type (D1)	Dummy for business type: 1 = commercial farm, 0 = family farm	0.47	0.69
Crossbred (D2)	Dummy for breed: 1 for crossbred , 0 otherwise *	0.03	0.17
Exotic breed (D3)	Dummy for breed: 1 for exotic breed, 0 otherwise*	0.25	0.56
Mixed breeds (D4)	Dummy for breed: 1 for mixed breeds , 0 otherwise*	0.05	0.04
Enterprise mix (D5)	Dummy for mixes of livestock types: 1 = poultry and other livestock, 0 = only poultry	0.91	0.45
Northeast region (D6)	Regional dummy, 1 for North East**	0.34	
Northwest region (D7)	Regional dummy, 1 for North West**	0.11	
North central coast (D8)	Regional dummy, 1 for North Central Coast**	0.22	
Central highlands (D9)	Regional dummy, 1 for Central Highlands**		0.13
Northeast south (D10)	Regional dummy, 1 for North East South**		0.21
Mekong River Delta (D11)	Regional dummy, 1 for Mekong River Delta**		0.33
Producer age (Z1)	Age of the producer (years)	45	44
Labor supply (Z2)	Number of adult persons available for farm work	2.43	2.00
Land size (Z3)	Total cultivated land (hectare per household)	0.33	0.39
Flock size (Z4)	Number of birds in the entire flock	1237	3641
Credit use (Z5)	Dummy for credit: Received credit for poultry production = 1, No = 0	0.04	0.10
Education (Z6)	Highest level of education of household head (average level)	3.3	3.3
Gender (Z7)	Dummy for gender of the household head: 1 = female, 0 = male	0.19	0.17
Market distance (Z8)	Distance of the farm from nearest major market (km)	1.3	2.5
Sale at market place (Z9)	Share of product sold at the market place (%)	32	26
Govt inputs (Z10)	% of veterinary inputs and stocks received from government enterprises, department of agriculture or cooperatives	42	25
Visits by govt service providers (Z11)	Number of yearly visits/inspections by the providers of services by government and quasi government organizations and cooperatives	0.2	0.2
Home produced crude material (Z12)	Ratio of home produced crude materials and fodder crops to total crude materials and fodder crops	0.61	0.46

US$ 1 = 14008 D (Vietnam Dong) in 1999.
* The base is the producer having local breed;
** The base zone in the North region is Red River Delta and in the South is South Central Coast.
Source: Field survey 1999.

rather adversely affected the effects of some other variables like breed and farm type, so product type was excluded from the model.

The variables explaining inefficiency include household characteristics, scale of operation (flock size) and access to resources such as credit, market, assets, information, and services. Access to credit for poultry production may increase the ability to use better quality inputs and services, hence reduce inefficiency. Higher levels of formal education and training are expected to reduce inefficiency. Female-headed farms may be less efficient due to less education, training, and management skills. If the distance of the nearest major market (secondary market) where the producers may sell their product or buy their inputs is long, transaction costs may be higher contributing to inefficiency. On the other hand, if prices of output and input in distant major markets in relation to local markets are such that they more than compensate the higher transactions costs, then access to distant markets may contribute to reduce inefficiency. The supply of inputs from government sources is expected to reduce inefficiency if quality is better and farmers get them at a lower price than other sources. The outcome may be opposite if the quality is poor and/or the inputs and services are not supplied at the optimal time. Existence of non-agricultural sources of income implies greater access to assets and liquidity to acquire productive inputs. Higher non-agricultural income therefore may contribute to reduced inefficiency. It may also increase inefficiency if less attention is given to farming due to less dependence on farming compared to other activities. Access to information, extension and veterinary services, and frequent visits by the government organizations and cooperatives are expected to reduce inefficiency, because such services are expected to promote adoption of new technology and improve technical knowledge and management skills of the producers. Home produced feeds (crude materials and fodder crops) are likely to be of poorer quality than standard feeds bought from the market, so a higher share of home produced feed use may increase inefficiency.

RESULTS AND DISCUSSION

Poultry Production Behaviour and Inefficiency Effects

The maximum-likelihood estimates for the parameters in the stochastic frontier and inefficiency equations for the producers in the North and in the South are presented in Tables 2 and 3 respectively. The values of

TABLE 2. Maximum Likelihood Estimates for Parameters of the Stochastic Frontier and Inefficiency Models for Chicken Production, North Vietnam, 1999

Production factors	Coefficients	Inefficiency factors	Coefficients
Constant	5.512***(0.248)	Constant	0.218(0.486)
Stock (lnX1)	0.103***(0.013)	Producer age (Z1)	0.004(0.005)
Labor (lnX2)	0.108***(0.023)	Labor supply (Z2)	–0.097**(0.057)
Feed (lnX3)	0.425***(0.019)	Land size (Z3)	–0.210***(0.024)
Crude feed ratio (lnX4)	–0.013***(0.004)	Flock size (Z4)	–0.0001***(0.0004)
Housing (lnX5)	0.121***(0.022)	Credit use (Z5)	–2.421***(0.618)
Vet cost (lnX6)	0.026***(0.009)	Education of household head (Z6)	–0.111**(0.067)
Farm type (D1)	0.292***(0.039)	Gender of household head (Z7)	0.260***(0.112)
Crossbred (D2)	0.225***(0.095)	Market distance (Z8)	–0.059*(0.047)
Exotic breed (D3)	0.527***(0.067)	Sale at market place (Z9)	–0.002***(0.001)
Mixed breed (D4)	0.371***(0.082)	Contract sale (Z10)	–0.026***(0.005)
Enterprise mix (D5)	–0.139***(0.062)	Inputs from govt (Z11)	0.001(0.001)
Northeast (D6)	–0.031(0.042)	Visits by govt service providers (Z12)	–0.097*(0.061)
Northwest (D7)	0.087*(0.057)	Home produced crude material (Z13)	0.143(0.129)
North central (D8)	–0.089**(0.051)		

Variance (= σ^2) = 0.388***(0.041) ; $\gamma = \sigma^2_u / \sigma^2$ = 0.669***(0.047)

Log-likelihood function =–467.20; Test statistic λ (df = 15)[1] = 84.59***

***, ** and * show statistical significance at the 1 percent, 5 percent and 10 percent level respectively; Figures in parentheses are standard errors;

1. Log-likelihood ratio test for the null hypothesis that the inefficiency effects are not present, H_0: $\gamma = \delta_0 = \ldots = \delta_{16} = 0$. Test statistic $\lambda = -2 \ln [L(\omega) / L(\Omega)]$, where $L(\omega)$ and $L(\Omega)$ are the values of the likelihood function under the under the null and alternative hypotheses H_0 and H_1 respectively. This statistic has a mixed χ^2 distribution (Coelli, 1994).

Source: Field survey 1999

the σ^2, γ, log likelihood function and test statistic λ and their significance level indicate that inefficiency effects of a stochastic nature exist in both regions but at a higher degree in the South. Average efficiency in the North and South was respectively 76.8% and 69.4%, indicating that respectively 23% and 31% potential efficiency remained unexploited in the two regions. However, most producers in the North are using local breeds with lower production potential than exotic or crossbreds. In the South, adoption rate for improved breeds is higher and level and variability in efficiency is also higher.

The estimated coefficients of the input variables of the frontier production function are all positive as would be expected. All are significant at the 1 percent level. The elasticity for all inputs are small and their sum equals significantly less than unity indicating decreasing returns to scale in both regions.

The coefficient of the ratio of crude materials and fodder crops to total feed is negative and significant in both the regions indicating that the

TABLE 3. Maximum Likelihood Estimates for Parameters of the Stochastic Frontier and Inefficiency Models for Chicken Production, South Vietnam, 1999

Production factors	Coefficients	Inefficiency factors	Coefficients
Constant	4.295***(0.425)	Constant	0.175(0.967)
Stock (lnX1)	0.042***(0.014)	Producer age (Z1)	–0.061***(0.022)
Labor use (lnX2)	0.191***(0.052)	Labor supply (Z2)	0.208(0.178)
Feed (lnX3)	0.597***(0.041)	Land size (Z3)	–0.003(0.382)
Crude feed ratio (lnX4)	–0.009**(0.005)	Flock size (Z4)	–0.0001***(0.0004)
Housing (lnX5)	0.067**(0.038)	Credit use (Z5)	1.187**(0.672)
Vet cost (lnX6)	0.021*(0.015)	Education of hh head (Z6)	–0.102(0.119)
Farm type (D1)	–0.062(0.100)	Gender of hh head (Z7)	–0.801(0.941)
Crossbred (D2)	0.127(0.141)	Market distance (Z8)	–0.091***(0.014)
Exotic breed (D3)	0.547***(0.131)	Sale at market place (Z9)	0.009***(0.004)
Mixed breed (D4)	0.360**(0.198)	Contract sale (Z10)	–0.011(0.013)
Enterprise mix (D5)	–0.146**(0.090)	Govt inputs (Z11)	0.013***(0.004)
Central highlands (D9)	–0.146*(0.094)	Visits by govt service providers (Z12)	0.035(0.097)
Northeast south (D10)	–0.117(0.116)	Home supplied crude feed (Z13)	1.086***(0.532)
Mekong Delta (D11)	–0.011(0.110)		

Variance (= σ^2) = 1.442***(0.210) ; $\sigma^2_u / \sigma^2 = \gamma$ = 0.897***(0.025)
Log-likelihood function =–214.75; Test statistic λ (df = 15)[1] = 82.50***
***, ** and * show statistical significance at the 1 percent, 5 percent and 10 percent level respectively; Figures in parentheses are standard errors;
1. A note on this test is provided in Table 2.

Source: Field survey 1999

marginal productivity of crude materials and fodder crops is significantly lower than the concentrate feed. Thus it appears that the mix of feed strongly influences chicken productivity.

The coefficient of farm type dummy (D1) is positive and significant in the North indicating that commercial farms there are more productive than household farms. The coefficients of dummies representing different improved breed poultry production indicate that the improved breeds, especially exotic breeds (D3), are more productive than local breeds in both the regions. Specialised poultry producers are more productive than farms having a mixture of livestock enterprises (D5) in both the regions perhaps because specialised producers give concentration to a single enterprise rather than distributing efforts to several things.

In the North, compared to Red River Delta region, productivity is higher in the North West region but lower in the North Central Coast region. In the South, compared to South Central cost region, only Central Highlands is less productive.

Among the thirteen inefficiency factors, 10 are significant at the 10% level or less in the North and seven in the South. However, the set of sig-

nificant factors and the direction of influence of a specific factor is not always the same in the two regions. Larger flock size (Z4) significantly reduced inefficiency in both the regions. Larger flock size generally helped derive economies scale in input purchases and output sales. About 96% of local and 68% of crossbred poultry producers were small, so these types of farms generally exhibited small farm behaviour, i.e., were less efficient. However, 28% of exotic poultry producers were small in both regions, about 39 and 34% were medium in the North and the South respectively, and the remainder were large. Analysis of cost per unit of output for exotic poultry showed that scale economies exist in the North but not so clearly in the South (Table 4). This is mainly because of the economy in feed purchases that occupy the largest share in the total cost. In the North, medium producers spend more on home supplied feed, veterinary medicine and service, and parent stock purchase but economize on labor and purchased feed. In the South, the diseconomy of the large farmers may have resulted from higher cost of concentrate feed, veterinary cost and parent stock purchase, though labor cost was lower. Moreover, the diseconomy may have resulted from the inefficient use of the quantity of feed and parent stock, not from prices. The feed prices were the same for all groups and the large farmers in the South bought parent stocks at lower unit prices than the small and medium producers. This implies that the use and composition of feed is very important to derive economies of scale in production. The medium farms in the South are most efficient.

Longer distance to nearest market (Z8) significantly reduced inefficiency as generally unit output price received was higher and unit input price paid was lower. In the South, older household head had significantly lower inefficiency but age had no significant effect in the North. More members available in the family for farm work (Z2) and larger land holding (Z3) significantly reduced inefficiency in the North but neither had significant effect in the South. Given severe land scarcity in

TABLE 4. Farm-Level Input Costs for Production of Exotic Chicken Meat by Flock Size, Vietnam, 1999

	North			South		
Description of inputs	Small	Medium	Large	Small	Medium	Large
Total Cost (000 D/ton)	12789	10084	5124	9518	8011	8594
Feeds as % of total cost	58	63	65	63	78	61
Labour as % of total cost	31	14	8	25	9	4

Source: Field survey 1999

the North, relatively larger land holding may give greater incentive for farmers to put more family labour in agricultural operations including poultry production due to their higher degree of dependence on agriculture. Also larger land size may generate adequate cash income to make complementary investment in poultry. Access to credit (Z5) significantly reduced inefficiency in the North but significantly increased inefficiency in the South. Normally, access to credit is expected to leverage cash constraint and allow purchase of better quality inputs and services, leading to increased productivity and efficiency. Therefore, the opposite result in the two regions may be due to the purpose for which the credit was used but details on this could not be ascertained from the field data. Credit for stock purchases might not reduce inefficiency if adequate feeds and veterinary inputs were not provided, for example.

Sale of a larger proportion of output at the market place rather than at farm gate (Z9) and sale of a higher proportion of output through contract (Z10) both significantly reduced inefficiency in the North but sale at market increased inefficiency and contract sale had no effect in the South. These differences might have resulted from different prices received for product and different transactions costs in different market outlets. Higher proportion of veterinary inputs and stocks received from the government institutions (Z11) significantly increased inefficiency in the South but had no effect in the North. Larger number of extension visits by government and other formal organizations (Z12) significantly reduced inefficiency in the North but had no effect in the South. Thus it appears that government supplied inputs and services had dissimilar effects on efficiency in the two regions perhaps because of the differences in quality and timeliness of the services provided. Generally government supplied inputs may not always be of best quality and they may not be accessible at the optimum time, which may affect productivity and efficiency. Higher proportion of home produced crude feed material (Z13) significantly increased inefficiency in the South perhaps because of the poor quality of such material, but it had no significant effect in the North perhaps because the quality was fairly uniform among all users.

Better education of the household head (Z6) significantly reduced inefficiency in the North perhaps because education helps better information gathering and application, but education had no significant effect in the South. Female headed households (Z7) were significantly less efficient in the North but sex of household head had no significant effect in the South. Female headed households were generally less educated and had fewer resources, which might have reduced their efficiency.

In order to identify the most important characteristics of least performing and best performing farms, following Okike et al. (2001), we classify top 10% of the farms to be most efficient and bottom 10% to be least efficient. Thus the groups constitute a thick frontier at the top and another thick frontier at the bottom. The characteristics of least efficient, most efficient and all farms in the North and the South are shown in Tables 5 and 6 respectively.

In the North, the mean values of all the inputs per unit of output are higher for the least efficient farms. Per unit use of three of the most important inputs–stocks, labour, and purchased crude feeds–is particularly significantly higher for the least efficient farms. Among the factors, which affect inefficiency, the mean values of almost all the factors are higher for the efficient farms (except for age of the producer and use of inputs from government sources). The level of education is significantly higher for the most efficient farms indicating that education plays a very important role in reducing inefficiency.

TABLE 5. Selected Characteristics of Least and Most Efficient Poultry Farms, North Vietnam, 1999

Variables/characteristics	Least efficient farms (n = 79)	All farms (n = 788)	Most efficient farms (n = 79)	p > t/ p < t
Mean efficiency (%)	52.96	76.81	91.50	0.00
Value of output (000'D/household)	4758.00	26369.80	86569.00	0.00
Value of parent stocks (000'D/kg live weight)	6.34	3.33	3.54	0.01
Annual labour (days/kg live weight)	0.35	0.14	0.06	0.00
Crude feeds purchased (kg/kg live weight)	2.62	1.33	0.71	0.00
Concentrate feed (kg/kg live weight)	0.67	0.44	0.60	0.40
Home feed (kg/kg live weight)	3.53	1.66	0.83	0.00
Housing area (sq. m/kg live weight)	0.27	0.14	0.06	0.00
Veterinary cost (000'D/kg live weight)	0.15	0.15	0.06	0.01
Age of the producer (years)	45.53	45.32	43.44	0.07
Adult members for farm work (persons/household)	2.25	2.43	2.54	0.06
Cultivated land (hectare/household)	0.25	0.33	0.57	0.08
Average education level	3.00	3.30	3.38	0.00
Credit for poultry (000'D/live weight)	0	282.49	1937	0.01
Distance of the nearest major market (km)	0.93	1.30	1.69	0.05
Output sold in the market (percent)	29.96	31.97	19.75	0.10
Output sold by contract (percent)	0.01	2.71	16.33	0.00
Vet. inputs and stocks from govt/cooperatives (%)	41.56	42.37	37.72	0.01
Mean visits by govt. service providers to the farm	0.04	0.19	0.58	0.03

Note: the last column shows the level of significance for t-test for testing the differences of mean characteristics between least efficient and most efficient farms.

Source: Field survey 1999

TABLE 6. Selected Characteristics of Least Efficient and Most Efficient Poultry Farms, South Vietnam, 1999

Variables/characteristics	Least efficient farms (n = 25)	All farms (n = 253)	Most efficient farms (n = 25)	p > t/ p < t
Economic efficiency (%)	28.17	69.38	87.86	0.00
Value of output (000'D/household)	9385.60	116297.50	478846.00	0.00
Value of parent stocks (000'D/kg live weight)	7.90	5.35	2.74	0.01
Annual labour (days/kg live weight)	2.35	0.33	0.15	0.05
Crude feeds purchased (kg/kg live weight)	35.66	4.49	0.74	0.14
Concentrate feed (kg/kg live weight)	13.16	2.43	0.88	0.13
Home feed (kg/kg live weight)	24.27	2.86	0.04	0.10
Housing area (sq. m/kg live weight)	1.49	0.22	0.05	0.07
Veterinary cost (000'D/kg live weight)	16.77	2.13	0.12	0.16
Age of the producer (years)	40.80	44.32	44.38	0.09
Adult members for farm work (persons/household)	1.92	2.00	2.00	0.71
Cultivated land (hectare/household)	0.27	0.39	0.64	0.09
Average education level (1, 2,…,7)	3.08	3.30	3.58	0.19
Credit for poultry (000'D/kg live weight)	7979	1695.95	28.82	0.01
Distance of the nearest major market (km)	2.13	2.55	3.17	0.09
Output sold in the market (percent)	58.00	26.13	12.70	0.00
Output sold by contract (percent)	0.01	4.11	7.12	0.09
Vet inputs and stocks from govt/cooperatives	53.40	24.94	14.00	0.00
Mean visits by govt. organizations and cooperatives	0.60	0.2	0.1	0.04

Note: the last column shows the level of significance for t-test for testing the differences of mean characteristics between least efficient and most efficient farms.

Source: Field survey 1999

In the South, input use of the least efficient farms is also higher as in the North (Table 6). Among the variables that influence inefficiency, the most noteworthy difference between the North and the South is observed in the use of credit. Unlike in the North, the efficient farms in the South use less credit. Also the most efficient producers in the South sell proportionately less at the market, as the distance gets longer. Thus market conditions contribute to the higher level of inefficiency in the South to a greater extent. Unlike in the North the most efficient farmers in the South are older

SUMMARY

In general there are significant differences in the production behaviour and efficiency level between the North and the South, between poultry and pig production, between different breeds of poultry and pig production, mixed and specialised farms, between household and busi-

ness farms, and between producers located in different agro-ecological regions.

Chicken production exhibited economies of scale in the North but not so clearly in the South. Exotic pig production in the South and crossbred pig in the North exhibited economies of scale while medium size farms were most cost efficient for exotic and local pig in the North and crossbred pig in the South. So liberalization policy may improve efficiency and competitiveness in both poultry and pig production in the North, because flock and herd sizes may expand due to lower input prices. However it may cause inefficiency in the South if the same argument is used for output expansion and poultry and pig farms in the South become too large and lose the cost advantage due to lower technical performance.

There are some differences in the set of factors that influence efficiency and the direction of such influence. Use of better quality feed improved efficiency as would be expected but a significant proportion of crude materials and fodder crops were still being used and higher dependence on home produced crude materials reduced efficiency due to their poor quality. Therefore, to attain production potential of improved breeds in smallholder conditions, much can be gained by improving feed quality and management. Policy support to attain this goal may be the key to alleviate poverty of smallholders and let them participate in the market driven rural development process.

Education significantly improved efficiency level, so more access to formal and informal education may help smallholders to be more efficient and competitive. Women headed farms were generally less efficient, which could be due to their lower level of education, knowledge, and skill in managing improved technology and also lower access to resources. Access to credit generally improved efficiency by leveraging cash constraint to buy better quality inputs and services. Longer market distance improved efficiency while selling at local markets adversely affected efficiency. The reason for this is perhaps higher output and lower input prices at distant markets. Such price differences were more than compensated by extra transportation costs. Contract sale was not common and where practiced, it improved efficiency perhaps because of the guaranteed market and prices. Increased dependence on government supplied inputs such as feeds, stocks, and drugs reduced efficiency perhaps because of the poor quality and untimely delivery of such inputs. On the other hand, increased number of extension visits has improved efficiency. Private extension delivery is still not available. Therefore to optimise public investment for improving productivity and efficiency, especially of the smallholders, government should fully

withdraw from input supply businesses consistent with the policy of liberalisation rather than moving slowly in this field. Instead public expenditure on extension and education and specialised training should be expanded as these have significant positive effect on efficiency and there are no alternative suppliers.

NOTE

1. Coelli and Battese (1996) used this formulation for a time variant model. Here we use cross-section data and therefore specify the formulation as required.

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