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EFFICIENCY OF ZIMBABWEAN SMALL SCALE COMMUNAL FARMERS

A. Mushunje[1] and A. Belete[2]

This paper investigates the allocative efficiency of two samples of communal area farmers in Manicaland province of Zimbabwe. The first one is made up of maize producers and the other of cotton producers. Maize is the staple food for most Zimbabweans and cotton has, as of late become the most popular cash crop for these small-scale communal (SSC) farmers. For each crop the Cobb-Douglas production function model is used to investigate the allocative efficiency of the maize and cotton producers. The tests for allocative efficiency are performed by estimating the equations for the Cobb-Douglas production function model. The findings of this paper show that the SSC farmers are utilising the fertilizer resource efficiently but they are under- utilising land, seed and insecticides. These producers are over-utilising labour and capital.

1. INTRODUCTION

This study looks at farm efficiency because it is an important subject in developing agriculture where resources are limited but high population growth is very common. A study on the efficiency of these small-scale communal farmers is important because they are now producing the greater proportion of food consumed in the third world, especially sub-Saharan Africa (Odulaja & Kiros, 1996).

Allocative efficiency is defined as the ability to choose a technically efficient input/output combination that optimises a decision-maker's goal(s) given relative output/input prices (Rukuni, 1994). However Wang *et al* (1996) observe that allocative efficiency is evaluated from the producer's point of view of profit maximisation. It does not necessarily reflect social costs and therefore, is not necessarily efficient in the sense of social cost benefit assessment. An efficient farm is a farm using fewer resources than other farms to generate a given output (Kirsten & Van Zyl, 1998). Superior performance is shown by higher efficiency ratios, and production at a lower cost per unit. The theory of production economics is concerned with optimisation and optimisation implies efficiency (Torkamani & Hardaker, 1996).

[1] *A graduate student in the Department of Agricultural Economics, University of Fort Hare, Private Bag X1214, Alice 5700.*

[2] *Professor in the Department of Agricultural Economics, University of Fort Hare, Private Bag X1314, Alice 5700.*

The purpose of this paper is to assess the level of allocative efficiency of SSC farmers from Manicaland province, eastern Zimbabwe. The relationship between output and various socio-economic characteristics is also investigated. First, we present a brief overview of the study area and data. The economic model is discussed next, followed by a section containing the results and analysis. The last section offers some concluding remarks.

2. THE STUDY AREA AND DATA

Zimbabwe has a total land area of 39.6 million hectares. Thirty-three million hectares are reserved for agriculture while the rest is national parks, forests and urban settlements. Zimbabwe's land resources have been classified into five "natural regions" which represent land-use potential according to average rainfall quantities and their variability.

Manicaland is the only province in Zimbabwe where each of the five natural regions is represented. According to the last census in 1992 Manicaland was the most populous province of Zimbabwe. These statistics suggest a high demand for land by the people of this province.

Data used in this paper refers to SSC producers of maize and/or cotton. Maize was chosen because it is the country's major crop, occupying more than 50% of all land cropped and providing more than 65% of gross farm income (Dalton *et al*, 1997). As for cotton the small-scale farmers now produce more than 50% of the entire marketed crop.

Secondary data was obtained from government institutions including the Central Statistics Office (CSO), Ministry of Lands, Agriculture and Resettlement, Department of Extension, banks and farmer organizations. like the Commercial Farmers Union (CFU). Primary data was collected in two parts. The first one was from verbal discussions with extension officers, bank officials and local school teachers and traditional leaders. The second part consists of farm level data obtained from a cross-sectional survey of SSC farmers from the five natural regions of Manicaland. Data on household composition, farm production, inputs and other socio-economic characteristics were collected via a questionnaire which was administered to 45 maize producers and 34 cotton farmers. For maize the 1999/2000 season was used and for cotton we used the 1998/99 season since the 1999/2000 one was affected by floods.

Multi-stage sampling design was adopted taking into consideration the natural endowment of the farmer according to agro-ecological characteristics.

Four districts of Mutasa, Zimunya, Marange and Chipinge were deliberately chosen taking into consideration the coverage of all the five natural regions. Farmers were stratified according to whether they produced maize or cotton. For maize, natural regions I, II, III and IV were covered but for cotton only natural region V was considered. Descriptive household statistics for the relevant variables are presented in Table 1.

Table 1: Descriptive household statistics of variables used in the study

Variables	Maize producers		Cotton producers	
	Mean	Standard Deviation	Mean	Standard deviation
Farm size (ha)	2.6	1.6	8.0	2.2
Maize/cotton area (ha)	1.6	1.6	5.4	2.6
Seed (kg)	30.0	3.6	135.0	8.7
Labour (man days)	142.6	10.5	489.1	22.3
Capital (cattle numbers)	3.5	2.5	5.0	2.6
Insecticides (ZW$)	N/A	N/A	9110.0	361.6
Fertiliser (kg)	151.7	23.7	N/A	N/A
Household income(Z$W)	19930	3789.1	22700.0	3507.6
Age of household head(years)	50.6	11.3	49.4	1.3
Family size (numbers)	4.8	1.8	6.4	2.0
Education (years of schooling)	6.2	1.4	6.9	1.5

Source: Survey 2000

3. THE ECONOMETRIC MODEL

3.1 General consideration

A number of variables are known to affect agricultural production. As a result it is important to use models which relate production to these variables for better understanding of the functional relationships.

3.2 The production function form

In this study, the analysis focuses on two important crops grown by both small-scale and large-scale farmers. These are maize and cotton. Maize is the staple food and a cash crop among small-scale farmers. Cotton is the main cash crop for small-scale farmers in Zimbabwe.

A production function relating output to inputs is employed. Other 'conditioners' such as the socio-economic factors are considered. The

specification of the production function used is of the Cobb-Douglas type. The most general expression of the Cobb-Douglas function is

$$Y = AL^aK^b$$

where Y stands for output, L measures labour input and K capital. A is the constant term which represents the technology of the society that generated the observations upon which the parameters of the function were to be estimated. Parameter A might also be thought of as the combined impact of inputs that are considered to be fixed on the production function.

Two important properties of the Cobb-Douglas function (Coudere & Marijse, 1991) are:

a) the a and b are elasticities of production with respect to labour and capital:

$$a = \frac{\delta y / Y}{\delta L / L} \qquad b = \frac{\delta y / Y}{\delta k / K}$$

b) The function is homogenous of degree, a+b. If a+b>1, there are increasing returns to scale; a+b = 1 indicates constant returns to scale and a + b < 1 indicates diminishing returns to scale.

The Cobb-Douglas production function has a number of limitations. The major criticism of the Cobb-Douglas function is that it cannot represent the three stages of the neo-classical production function. It represents one stage at a time. Also, the elasticities of production for the Cobb-Douglas type of production function are constant irrespective of the amounts of each input that are used. Despite its well-known limitations, the Cobb-Douglas function is chosen because the methodology employed requires that the function be self-dual (Bravo-Ureta & Evenson 1994). Xu and Jeffrey (1997) also noted that although there are other more flexible forms the functional form has a limited effect on empirical efficiency measurement.

The general model for this study relating production, Y, to a given set of resources X, and other conditioning factors is given as follows:

$$Y = B_0 X_1^{B1} X_2^{B2} X_3^{B3} X_4^{B4} X_5^{B5} X_6^{B6}$$

Where:

X_1 = Land devoted to either maize or cotton (hectares)
X_2 = family and hired worker days used in maize or cotton production (man days)
X_3 = Capital (cattle numbers)
X_4 = Fertilizer used (kg)
X_5 = Seed used (kg)
X_6 = Cost of pesticides in ZW$
U = The disturbance term
Y = Annual total farm output of cotton or maize (tones)

B_1, B_2, B_3, B_4, B_5, and B_6, are elasticities to be estimated

2.3 Model specification

In order to be able to use the least squares procedure for estimating, the function is linearised and gives the following regression specification.

$$\text{In } Y = B_0 + B_1 \text{ In } X_1 + B_1 \text{ In } X_2 + B_3 \text{ In } X_3 + B_4 \text{ In } X_4 + B_5 \text{ In } X_5 + B_6 \text{ In } X_6 + U$$

According to Bravo-Ureta and Evenson (1994) several authors have investigated the relationship between efficiency and various demographic and socio-economic variables, but these analyses have been criticised by some who argue that the socio-economic variables should be incorporated directly in the production function model because such variables may have a direct impact on efficiency. But, as argued by the same authors, Kalirajan (1991) defended his practice by contending that the socio-economic attributes have a roundabout effect on production and, hence, should be incorporated into the analysis indirectly. Following the above argument, this study examined the possible relationship between efficiency and socio-economic characteristics by incorporating the following variables directly into the production function and investigate their effect on output.

(1) LAND SIZE = the total number of hectares held by the farmer
(2) FAMILY SIZE = total number of members of the household
(3) EDUCATION = the number of years of schooling completed by the household head
(4) AGE = the age of the household head
(5) INCOME = all income the farmer receives per annum (excluding income from crop under study)

Before the results are presented, it is important to state that an assumption was made about the variables used. It was assumed that all inputs are

sufficiently homogeneous and unambiguously defined. For example, labour was taken to consist of family and hired labour. The two types of labour were added together, thus implicitly assuming that they have the same effect on output. The same assumptions were made for other inputs like land, capital, fertiliser, seed etc. It is important to note however that the value of the elasticities might be somewhat affected by a possible heterogeneity of the inputs e.g. productivity of land from different natural regions, variety of seed and type of fertilisers. The effect of inter-cropping is also overlooked.

4. RESULTS OF THE EMPIRICAL ANALYSIS

The computer package, Shazam, was used to estimate the coefficients of elasticities of production. The ordinary least squares (OLS) estimates which show the average performance of the sample farmers and with the highest adjusted R^2 value (normal criteria of goodness of fit) were chosen. The results of the OLS regression estimates of production function for the two groups of farmers are presented in Table 2.

Table 2 shows that the estimations of the two production functions resulted in adjusted R^2 values of between 0,58 and 0,68, which means the inputs used in the model were able to explain between 58% to 68% of the variation in maize or cotton production by the two farming sectors. According to Coudere and Marijse (1991) an R^2 of 0,54 is a fairly good result for regression of cross-sectional data. This, then means that the 58-68 % range is quite a good result.

4.1 Elasticities of production

An elasticity of production coefficient for an individual input expresses the percentage increase (decrease) in output that will result if the particular input is increased (decreased) by one percent, holding all other inputs constant (Truran & Fox, 1979).

From the coefficients (column 2) it is evident that access to land is by far the most important variable explaining differentiation in output. Land elasticity is highly significant for both producer groups but especially for the communal area cotton producers. A one percent increase in the quantity of land will result in 0.81 and 1.11 percent increase in maize and cotton output respectively. The production elasticities for seed, labour and capital are quite low for both producer groups but mostly for cotton producers who gave negative values of elasticities for seed capital and insecticides. This exhibits some form of over-utilisation of the three inputs.

Table 2: **Production function estimates, by producer group**

Producer group and no of observations	Constant (1)	Land (2)	Seed (3)	Labour (4)	Capital (5)	Insecticides (6)	Fertilizer (7)	Sum of bs (8)	Adjusted R^2 0(9)
Maize producers (45)	0.10876 [1.389][a] (-1.597)[b]	0.80717* [0.223] (3.623)	0.18068 [0.205] (0.882)	0.10493* [0.228] (0.4656)	0.1169** [0.091] (1.282)	N/A[c]	0.21651 [0.0944] (2.2926)	1.4263	0.68
Cotton producers (31)	1.09186 [3.702] (-0.024)	1.1134** [0.748] (1.488)	-0.0215 [0.495] (-0.044)	0.20792 [0.404] (0.515)	-0.03940 [0.2338] (0.1494)	-0.06530 [0.27062] (-0.2413)	N/A[d]	1.1951	0.58

a *figures in brackets are standard error of the estimates.*
b *figures in parentheses are t-ratios of coefficients.*
c *the use of insecticides by maize producers is insignificant.*
d *communal area cotton producers do not use fertilisers*
* *significant at 5% level*
** *significant at 10%*

4.2 Returns to scale

To consider the returns to scale for each group of farmers it is necessary to add up the coefficients of elasticity of each individual group. The sum is then used as an indicator of returns to scale. Cornia (1985) stated that constant returns to scale are assumed to occur when the sum of the coefficients falls within the interval 0,95-1,05; below 0,95 or above 1,05 one has constant, decreasing or increasing returns. When farmers experience constant returns to scale they are indifferent as to whether they should increase production by increasing the bundle of inputs or should just continue to operate at that level of production.

The results show (column 8) that both groups of farmers seem to experience increasing returns to scale. As a result there are incentives for them to increase production until they experience constant returns to scale.

4.3 Efficiency analysis

Efficiency may be described as the relation between ends and means and has application in production analysis as well as consumption theory and demand analysis (Llewelyn & Williams, 1996). Its measurement is very important in agriculture because it is a factor for productivity growth. It helps to determine how much of the neglected resource(s) can be used to raise productivity given the existing resource base and the available technology. In traditional agriculture the study of efficiency helps to evaluate, recommend and formulate appropriate productive techniques that help to raise resource-use efficiency. Efficiency is normally looked at using economic efficiency's two components of technical and allocative efficiency. This study only looked at the allocative component.

4.4 Allocative efficiency

Whereas technical efficiency refers to the manner in which inputs are used, allocative efficiency is measured in terms of the amounts of inputs combined in production. While technical inefficiency arises as a result of the inability to produce the maximum output from given inputs, allocative inefficiency comes about as a result of the inability to combine inputs in optimal proportions given input prices.

A rigorous comparison of the allocative efficiencies of any two groups of farms requires that (a) they are represented by the same or neutral production function and (b) they are facing the same configuration of output and input prices. In this study the same Cobb-Douglas production function was used and the data show no significant variations in output and input prices. Farmers sell their products to depots that are well distributed all over the province. This reduces the differential transport costs that are incurred. Prices of inputs did not show much variation between farmers. As a result average prices were used for both groups of farmers.

Shapiro (1988) referred to allocative efficiency as the equivalent of marginal value product and marginal factor cost (MFC) of each factor. MVP is derived from the marginal physical product (MPP) or marginal productivity of an input. The marginal productivity of an input measures the additional or marginal output resulting from the use of one or more units of input *ceteris paribus* (Truran & Fox, 1979). The MVP of an input depends on the amount of that input being used, and on the levels of the other factors of production utilised.

To test the allocative efficiencies, this study adapted the method used by Bagi (1981) whereby the following equations for the Cobb-Douglas production function were estimated:

$$MVP_i = K_iP_i = a_i(V/X_i)$$

MVP_i is the marginal value product of the ith input. K is the allocative efficiency coefficient of the ith input and a_i is the output elasticity of the ith input. V is the geometric mean of the value of gross farm output. X_i is the geometric mean of the ith factor production, and P_i is the price of the ith factor of production.

The factor of production is over-utilised if $K<1$, and too little of the resource is being utilised in the production process if $K>1$. A ratio of MVP:MFC (Pi) which is 1 (i.e. $K=1$) implies that absolute efficiency has been achieved in the allocation of this particular factor of production.

Table 3 summarises the allocative efficiency values for each of the producer groups.

4.5 Allocative efficiency coefficients

Land

Table 3 shows some very surprising results, especially for the cotton producers. A heavy reallocation of land is needed to change the MVP of land

Table 3: Allocative efficiency coefficients (K_is) for the different producer groups

Inputs	Maize producers	Cotton producers
Land (ha)	1.20	3.13
Seed (kg)	3.37	10.86
Fertilizer (kg)	1.38	N/A
Labour (days)	0.53	0.72
Capital (Z$)	0.34	0.90
Insecticides (Z$)	N/A	1.20

in order to arrive at the equality of MVP and MFC. The maize producers do not under-utilise land to a great extent.

These farmers, especially the cotton producers, are expected to allocate land efficiently because of its scarcity. A number of reasons could explain the unexpected under-utilisation of land exhibited. One, the method used to come up with the MFC (price) of land, might be biased.

The SSC farmers do not have title deeds to their land. As a result there are no accurate guides relative to the cost of land against which to compare the MVP of land. Farmers are not allowed to sell their land and rentals are not permitted either although they are not uncommon. The area where rentals of approximately ZW$2000 per hectare were common is natural region give where cotton is produced. This figure of ZW$2000/ha was adopted because it is very close to the figures being charged by headmen and chiefs when they allocate land to new farmers, although this is illegal. This figure could be far below the opportunity cost of the land although according to government statutes all this land is valued at $1/ha. The other possible reason for the Ks>1 may be that these farmers are substituting labour for land since labour is abundant and cheap. As a result labour is being over-utilised.

Seeds

The results of allocative efficiency coefficients of seed are in contradiction with the results on the elasticities of production for this input, which suggests its over-utilisation. Table 3 shows that both categories of farmer, especially the cotton producers, are under-utilising this input. These results are not at all unexpected. The cost of seeds is very high in Zimbabwe. As a result farmers buy less of them and compensate for by other inputs like labour and capital. Farmers need to reallocate their input (resources) and try to increase the usage of this input, seed. Possibly there is also a need to look at the varieties grown.

Sometimes other varieties give better results.

Fertiliser

For both groups of farmers, the cost of fertiliser is rather beyond their capacity to buy and as a result they are under-utilising this input in favour of other cheaper inputs like labour and capital. Actually some farmers seem to be substituting fertiliser with certain farm operations involving manual labour such as weeding, hoeing or applying organic manure. A proper combination of various fertiliser nutrients, depending on the soil deficiencies and particular crop requirements, should be looked into.

Labour

This is the input that delivers the most interesting results. The results are in line with findings from the estimated input elasticities of production. Both groups of farmers make very intensive use of this input. Labour for both groups is made up of both family and hired labour. The allocative efficiency coefficients which are well below unity are a result of surplus labour, both family and hired. This is because, as noted by Truran and Fox (1979), in agriculture under surplus labour conditions the marginal product of labour is zero or near zero. The superfluous workers could theoretically be transferred to the industrial sector without a loss of production in agriculture.

When the supply of labour is excessively high its price will be low. Hence these farmers are investing more labour in agriculture and utilise less of the other inputs like fertiliser and other purchased inputs. Also the nature of the crops, especially cotton, dictates that more labour be used. Cotton is highly labour intensive especially during the harvesting (picking) periods. During data collection farmers pointed out that weeding for both crops and picking for cotton demands much of the labour. These farmers are resource poor and cannot afford to buy herbicides. As a result these farmers spray insecticides by hand. They cannot afford to hire aircraft to do the spraying for them.

Although the coefficient for labour is low and seems to reflect superfluous labour supply, the farmers noted that they experience seasonal labour shortages during certain periods. This is usually during weeding and, especially for cotton, harvesting. The reason is that hired labour also has to attend to their own plots during such peak periods.

Capital

The level of allocative efficiency for capital appears to follow a similar pattern to that of labour. Both groups of farmers own a number of cattle/donkeys that could be used as bullock labour, which was used as a proxy for capital.

Only the cotton producers approximate absolute allocative efficiency. The other group over-utilises the capital input. This is not surprising for either the maize producers or the cotton producers. They own this capital and as a result it has low opportunity cost outside agriculture. They tend to exhibit irrational capital usage. Anyone who is familiar with these producers' farming system will know that they use the cattle to plough the field twice before planting. They do what is called winter ploughing before the rains come to loosen the soil. After that they plough again at planting time after weeds start to germinate (weed control strategy). Just before weeding the land is ploughed again in between plant rows. This time the mouldboard is removed from the plough. This process helps to simultaneously destroy weeds and loosen the soil. Some farmers with planters use draught power to pull the planter.

When organic manure (anthill soil, humus or animal manure) is used animals are used to pull the scotch carts. At harvesting it is also animals that are used to transport the harvest to the storage building or to the market. Although the measure of the marginal unit cost of capital (or MFC) is imprecise, it is clearly evident that both groups of farmers are over-utilising capital.

Insecticides

The cotton producers exhibit some under-utilisation of the input. During data collection these farmers pointed out that this was the most limiting input in the production of cotton. The price of this input relative to the price of other inputs is very high. This has led quite a number of producers to quit cotton production. It is also why Cottco and Cargil, the companies that buy cotton come in and give loans to farmers in the form of insecticides. Because of the high cost of this input farmers tend to use less of it. More insecticides should be used to change the MVP in order for the MVP to equal MFC.

5. THE EFFECT OF SOME SOCIO-ECONOMIC VARIABLES ON EFFICIENCY

This study followed the argument that the socio-economic variables should be incorporated directly in the production function model because such variables may have a direct impact on efficiency. The OLS estimates for the parameters of the Cobb-Douglas production functions for the two groups of producers are given in Table 4.

Table 4: The elasticities of the production for maize and cotton producers by farming sector

Producer group and no of observation	Constant (1)	Income (2)	Land area (3)	Family size (4)	Age (5)	Education (6)	Sum of bs (7)	Adjusted R^2 (8)
Maize(45)	-0.5243	0.13	-0.19	-0.03	1.31	0.26	1.49	0.23
Cotton (34)	-2.9376	0.13	0.11	-0.15	0.44	0.26	0.80	0.12

5.1 Elasticities of production for the socio-economic variables

Table 4 gives adjusted R^2 values of between 0,12 and 0,23, which means that the socio-economic variables used in the model are able to only explain between 12% to 23% of the variation in maize or cotton production by the two groups of farmers. This shows that socio-economic factors have a low influence on efficiency.

Income

Although all the estimated coefficients are positive, their values are rather low. The positive signs mean that for percentage increase in income there is a positive resultant increase in output. For example, increasing income for both groups of communal area producers by 100 percent there would, *ceteris paribus*, be an increase of 13 percent in total output. Hence income has a low influence on both maize and cotton production. For the sample groups this means a heavy reliance on the two crops for their income. Maize and cotton crops in particular, and agriculture in general, prove to be the most important sources of income for these farmers. Any policy that is aimed at improving income distribution for small-scale farmers should take agriculture into consideration.

Farm size

The coefficient of land size is negative for maize producers which indicates that a 10 percent increase in land will result in a decrease of 1,9 percent for the value of production. This result implies that land is being over-utilised in this sector. Merely increasing the farm size, therefore, will not improve production. Other variables like capital, purchased inputs, skills, etc have to

be provided in adequate quantities first.

Family size

Surprisingly, the coefficients are negative in groups of producers. In terms of provision of labour it would be expected that family members are more productive than hired labour. Positive and high coefficients of elasticity were therefore expected. The results tend to indicate an over-utilization of family labour such that any additional member will reduce total production. The practice of polygamy, where some farmers have more than 10 wives in the resettlement area, does not seem to be productive.

Age

The estimated coefficients for age of farmers are positive for all groups of producers. This suggests that the older the farmer, the more productive he is. Although the opposite is usually the case, as young farmers are expected to be more innovative and receptive of new technologies, this result is not surprising. Young farmers do not take farming seriously. Also older farmers are expected to own their own cattle, scotch carts and other farming implements and do not depend on hiring. The elasticity of age is more than one for maize producers, which indicates that they are operating on increasing returns to age.

Education

The elasticities of education are positive for all groups of farmers. These results tend to indicate that farmers with more years of formal schooling tend to be more productive. The farmers with more education respond more readily to new technology. Although an additional year of schooling might result in some positive increments in output the changes, especially for RA-maize, are quite marginal. Since most of the farmers have had 6-8 years of schooling, it may have been so elementary that it does not have much effect on agricultural productivity. Tertiary education especially from agricultural colleges might give much higher elasticities of production.

6. CONCLUDING REMARKS

With the present form of resource allocation it seems both groups of farmers are relatively efficient in fertiliser utilisation. This is because returns to fertiliser are close to the cost of a unit of this input. High coefficients for land, seed and insecticides indicate that these resources are being under-utilised. As a result there is ample room for increasing output by increasing investments in these inputs, especially seed. The quality of seeds should be assessed, as this can also affect production.

As far as labour and capital are concerned there is a very intensive use of these inputs. Therefore government intervention of any form should be designed in such a way that it encourages the intensity of labour use, e.g. growing labour intensive crops. Since land seems to be in short supply the farmers are trying to raise yields by increasing labour inputs per hectare. In other words they are substituting land with labour.

The findings from this study do not seem to confirm the opinion of Theodore W. Schultz, that traditional agriculture is poor-but-efficient. In terms of allocative efficiency producers are either under- or over-utilising resources. The inconsistency with Schultz's hypothesis may be due to some market distortions or also due to policy interventions that perhaps induce allocative inefficiency.

A number of policy interventions need to be made by the government if small-scale farmers are to improve their allocative efficiency. These include increasing minimum land size for these farmers so that they operate viably. The government can endeavour to employ adequately trained extension advisors so that they can improve the extension services that are pivotal to achieving allocative efficiency. Training and providing financial assistance through credit is also important, as these farmers are resource poor. The provision of free or subsidised inputs can also enhance allocative efficiency, as farmers will not resort to the practice of substituting labour for other inputs just because labour is in abundance relative to the other inputs, which are out of reach of most of the farmers.

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PROJECTING INTERNATIONAL DEMAND FOR AND SUPPLY OF PROTEIN FEED

S.M. McGuigan[1] and W.L. Nieuwoudt[2]

South Africa is currently a net importer of protein meal with 1998 imports exceeding R1 billion. Information regarding the cost of future imports will assist South African decision makers with regard to stimulating the South African protein industry. A spreadsheet model which readily allows scenario analysis is developed to project future supply of and demand for protein feed. Estimated price elasticities of supply and demand enable the model to project equilibrium consumption and price until 2020. The model incorporates as growth parameters: income growth, population growth and income elasticity of demand. It also allows for income elasticities to decline as incomes rise. Assuming a 3% annual growth in supply, the model forecasts that real price for protein meal will remain relatively constant to 2020. However, if supply increases linearly price is forecast to increase 22% by 2020. Developing Asia, notably China, accounts for most demand growth and projections are sensitive to growth assumptions for China.

1. INTRODUCTION

Protein feed consumption in South Africa has increased significantly in recent years and South Africa is currently a net importer of oilcake with 1998 imports exceeding R1 billion. These meal imports are largely composed of soybean cake for use in the poultry industry. A recent study indicated that South African oilcake consumption in 2020 could be substantially above current levels (Nieuwoudt, 1998b). The Protein Research Trust (PRT), in planning for this possible increase in future demand, is interested in the projected international supply of and demand for oilcake up to 2020. Projections are needed to aid decision making about whether sufficient future supplies of oilcake will be available at low prices on the world market, which will influence the priority given to local production. Currently the PRT is involved in stimulating South African production of protein meal, largely through investing in research and farmer education.

The objective of this study is to project the international price and consumption of protein feed to 2020 under different scenarios. A

[1] *Post Graduate Student, Discipline of Agricultural Economics, School of Agricultural Sciences and Agribusiness, University of Natal.*

[2] *Head of Discipline of Agricultural Economics, School of Agricultural Sciences and Agribusiness, University of Natal.* *The work was funded by the Protein Research Trust.*