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Full Length Research Paper

The efficiency of small-scale agriculture in Limpopo province of South Africa

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The aim of this study is to evaluate the efficiency of the small scale farmers for the production year 2006/2007 in Limpopo province using policy analysis matrix. A total of twelve production systems were selected. Result shows that all were profitable under market condition with existing policies and all except dry land maize had comparative advantage suggesting efficiency in the systems. Ranking the systems in term of private cost ratio and domestic resource cost, irrigated vegetables like potatoes, cabbages and tomatoes had higher profitability and comparative advantages than field crops like both dry and irrigated maize, peanut and beans. Despite competiveness in all and comparative advantage in most systems, these was not due to policy intervention as incentive indicators, e.g. subsidy ratio to producers, shows that all production systems are being taxed indicating little motivation from policies for small scale farmers to production.

Key words: Policy analysis matrix, small-scale farmers, efficiency, South Africa.

INTRODUCTION

Agricultural policy is a critical element in determining the rate and pattern of economic growth (Monke and Pearson, 1989). The importance of food as a basic need and in providing cheap food to keep wages low in the process of economic development has caused governments to intervene in food market in various ways (Najafi, 2005). Many governments intervene directly in agricultural product markets, with the objectives to redistribute income, generate public revenues, correct market failures and provide incentives to producers (Braverman et al., 1983). Government intervention plays a critical role in 'kick starting' markets by establishing coordinated exchange systems at a critical time (DFID, 2004). South Africa has undergone immense social and economic change over the last 10 years led by the abolition of apartheid. An underlying principle for virtually all government policies is to bring the previously excluded black community into the mainstream economy through job creation and entrepreneurship (OECD, 2006). As part of the South African agricultural policy, the government intends to increase the income of the poorest group in the society by making small-scale agriculture more efficient and internationally competitive, so as to stimulate increase in number of small-scale and medium-scale farmers and conserve agricultural natural resources specifically in revitalising existing schemes to make them more productive (IPTRID, 2000; NDA, 1998).

South Africa is a water scarce country with very low rainfall at an average of about 500 mm per annum which is strongly seasonal and highly irregular in occurrence with Irrigation being an important factor in the production of permanent crops or in obtaining high yield from field crops (Oosthuizen, 2005). However, with limited opportunity for large scale expansion due to limited water availability, smallholder irrigation is envisioned to play a vital role in South Africa in achieving household food security and improving the livelihood of the country's rural population (IWMI, 2007). That is while an aim of the agricultural policy is to revitalise existing small-scale irrigation schemes (NDA, 1998).

Since government finance is a limited resource with conflicting needs, its efficient allocation should be paramount to any policy objective. Therefore a comprehensive

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Table 1. The framework of the policy analysis matrix.

	Revenue	Cost		Profit
		Tradable	Non tradable	
Private price	A	B	C	D
Social price	E	F	G	H
Divergence	I	J	K	L

The symbols (capital letters) are defined as follows:
A : Revenues in private prices (market prevailing prices, also called accounting prices).
B : Costs of tradable inputs (such as fertilisers, seeds, plastic mulch, etc.) in private prices.
C : Costs of domestic factors (such as labour, capital, etc.) in private prices.
D : Private Profits (D=A-B-C).
E : Revenues in social prices (economic efficiency prices or shadow prices).
F Costs of tradable inputs (such as fertilisers, seeds, plastic mulch, etc.) in social prices.
G : Costs of domestic factors such as (labour, capital, etc.) in social prices.
H : Social profits (H = E-F-G).
I : Output Transfers (I = A-E)
J : Input Transfers (J=B-F)
K : Factor Transfers (K=C-G)
L : Net Transfers (L=D-H or L=I-J-K)

assessment of small-scale agricultural system is essential to see if government's intervention is worth-while. Thus this study seeks to determine the efficiency of the small-scale irrigation sector of Limpopo Province.

METHODOLOGY

Study area

The study was carried out in Limpopo Province, one of South Africa's nine provinces found in the northernmost part of the country. It covers an area of 12.46 million ha accounting for 10.2% of the total area of South Africa. The provincial population of 5.56 million is divided into five districts of Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg. The population is pre-dominantly rural consisting of about 89% of the total with the main occupation of the people being agriculture. It has a dual agricultural system consisting 5000 large-scale commercial farmers who occupied 70% of the prime land and 273000 small-scale farmers occupying the remaining 30% of the land. Most of these small-scale farmers are in the former homeland majority of who are women (PROVIDE, 2005; Nesamvuni et al., 2003; LDA, 2006). Limpopo is one of the richest agricultural regions of the country noted for its production of fruits and vegetables, cereals, tea and sugar with agriculture playing a major role in its economic growth and development (M'Marete, 2003).

Bembridge (2002) identifies 167 existing irrigation schemes in the province with small-scale farmers found operating on 117 of these. The small-scale irrigation schemes have about 10,150 farmers with an average individual land holding of about 1.5 ha per farmer.

Data collection and analysis

312 farmers were randomly selected from 15 active irrigation schemes and 10 non-active irrigation schemes or dry-land schemes found in the province. A semi structured questionnaire was issued for production information of 2006/2007. Information was further gathered from extension officers. This information was used for the estimation of farm budgets that represent the costs and returns to production activities. Policy analysis matrix (PAM) was used to assess the efficiency of small-scale agriculture in Limpopo Province. PAM measures the competitiveness and the comparative advantage of existing systems and also the impact of policy on these systems. PAM is a computational framework, developed by Monke and Pearson (1989) for measuring input use efficiency in production, comparative advantage, and the degree of government interventions.

The primary strength of the PAM is that it allows desegregations of the production activities, assessment of the effects of policy induced transfers, and individual and net effects of seemingly conflicting sets of policies, therefore making it usage very straightforward (Nelson and Panggabean, 1991). PAM suffers a weakness of the assumption of fixed input-output coefficients. Nevertheless, it can readily accommodate such parameter changes using sensitivity analysis (simulation). Also PAM can not be constructed for a crop without an international price. The basic format of the PAM as shown in Table 1 is a two-way accounting identities. The PAM table consists of private and social profitability in its first and second rows and divergences in its third row. The private profits evaluated at market prices and social profits evaluated at social or efficiency prices. If there are no market distortions, the two are often the same. If, however, there are market failures or distortions then the two would diverge from one another. Their divergence acts as a signal for policy intervention.

Data modelling

Twelve production systems (dry land maize and sorghum, and drip irrigation systems for maize, tomatoes, onion, peanut, potatoes, beans, green beans, chillies and sweet potatoes) were selected. Production factors were broken down into tradable outputs and inputs, factor or domestic inputs for the construction of the PAM model was constructed.

Tradable inputs and outputs

For all inputs and outputs except pesticides, fuel and electricity, c.i.f. prices obtained from the department of trade and industry were used as social prices while the actual market prices were regarded as private prices. For pesticide and fuel, the social price was determined by tax on pesticides deducted from the market (private price). As for electricity, the tax intricacy could not be determined thus the same price was used for both private and social prices assuming no distortion.

Table 2. Private prices, social prices and net divergence for all crops.

Crop	Private profit	Social profit	Net divergence
Tomatoes	54435.20	150198.75	-95763.55
Dry MAIZE	1026.20	-278.15	1304.35
Irrigated maize	2949.70	7427.69	-4477.99
Sorghum	3469.20	2523.25	945.95
Onion	36274.20	100671.22	-64397.02
Cabbage	58771.70	100215.04	-41443.34
Peanut	3038.20	9705.50	-6667.30
Beans	539.95	6588.15	-6048.20
Green beans	16988.70	64992.39	-48003.69
Potatoes	49456.60	175144.92	-125688.32
Chillies	13834.00	38983.93	-25149.93
Sweet potatoes	14918.80	72522.59	-57603.79

Production factors

Labour: Minimum labour wage for rural farm workers was used as private labour cost while the competitive price paid by the local farmers to labour was used for social price.

Tractor, pumps and drip pipes: The Social costs of tractor pump and drip pipes were derived from deduction taxes from the private costs and were then discounted (cost of recovery). Their contribution per hectare productivity was determined and used as social prices.

Land, water, and management skill*:* The value of agricultural land, for example is determined by the land's worth in growing alternate crops. However, due to lack of specialization this valuation was difficult to determine, therefore a crop's profit will be interpreted as rent to land and other fixed factors (e.g. management and ability to bear risk) per hectare of land used. Small scale irrigation farmer are not charged for water use, resulting to no private value for its usage. Therefore, like land and management, profit for water will interpreted as return to these factors.

RESULTS

All crops have positive private and social profits except dry land maize, with negative social profitability (Table 2). Positives private profitability for all crops indicates that, they are profitable under present policies. This profit indicates return to factor of production (land, management and water) Therefore, there exits opportunities for their expansion. Positive social profit implies that even without distorting policies in place, all crops except sorghum are profitable. Indicating that with the exception of sorghum, it may be more profitable to produce the crops than to import. In terms of Net transfer, dry land maize and dry land sorghum have positive values which indicate that resources are transferred from other sector of the economy in to their production. As concern the other production systems, the net policy effects show that there were transfers of income from the farmers to the state.

According to the calculated incentive indicators of subsidy ratio to producers (SRP), effective protection coefficient (EPC), nominal protection coefficient for tradable inputs (NPCI) and nominal protection coefficient for output (NPCO), government policies offered little or no protection to producers for majority of the systems. For instance, all production systems apart of dry land maize were implicitly taxed. This is as indicated by the negative SRPs. Dry land maize alone was implicitly subsidized. Also looking at the combine incentives of inputs and outputs as measured by the EPC, only dry land maize, irrigated maize and dry land sorghum did policies intervent in the form of protection to provide incentives to produce; the rest of the systems were not protected. The most protected is the dry land maize (EPC = 1.3398) while the least motivated is sweet potatoes (EPC = 0.2092). From the result on Table 3, NPCO > 1 for both dry land maize and irrigated maize show that there was incentive for their production (that is what they get for their production is more than as reflected by the world price). On the other hand, NPCI > 1 for all production systems show disincentive in their production. It showed that they pay more for their inputs as compare with the world price.

Due to the fact that the values of PCR for all production systems were less than 1, it is an indication that the entire production systems were profitable under existing market prices. However as shown by Table 4, cabbage (0.0741), tomatoes (0.0931) and potatoes (0.1109) are the most profitable crops to produce respectively, while beans (0.8956), irrigated maize (0.7018) and peanut (0.6310) were the least profitable crops respectively.

For all production systems except dry land maize, the DRC that measures comparative advantage of alternative systems are less than 1 as can be seen also in Table 4.

However potatoes had the highest comparative advantage (0.0114) followed by tomatoes (0.0132) and Cabbage (0.0155) as shown by the ranking. Therefore it will profit the state more to produce these crops

Table 3. Incentive and comparative advantage indicators.

Crop	PCR	DRC	NPCO	NPCI	EPC	SRP
Tomatoes	0.0931	0.0132	0.4106	1.0812	0.3944	-0.6143
Dry maize	0.4408	1.1407	1.0121	1.0792	0.9284	0.2934
Irrigated maize	0.7018	0.2529	1.0121	1.0624	0.9950	-0.3357
Sorghum	0.1351	0.4327	0.9088	1.2533	0.9018	0.2084
Onion	0.2108	0.0283	0.4654	1.0528	0.4436	-0.5994
Cabbage	0.0741	0.0155	0.6363	1.0634	0.6236	-0.3955
Peanut	0.6311	0.1535	0.7473	1.0560	0.7183	-0.5315
Beans	0.8956	0.2010	0.7303	1.0762	0.6275	-0.5654
Green beans	0.1547	0.0186	0.3436	1.0793	0.3035	-0.6873
Potatoes	0.1109	0.0114	0.3406	1.0850	0.3140	-0.6849
Chillies	0.2286	0.0380	0.4839	1.0661	0.4426	-0.5795
Sweet potatoes	0.3064	0.0284	0.3208	1.0588	0.2882	-0.7391

Table 4. Crops ranking by PCR and DRC.

Crop	PCR	Rank	DRC	Rank
Cabbage	0.0741	1	0.0155	3
Tomatoes	0.0931	2	0.0132	2
Potatoes	0.1109	3	0.0114	1
Sorghum	0.1351	4	0.4327	11
Green Beans	0.1547	5	0.0186	4
Onion	0.2108	6	0.0283	5
Chillies	0.2286	7	0.0380	7
Sweet Potatoes	0.3064	8	0.0284	6
Dry Maize	0.4408	9	1.1407	12
Peanut	0.6311	10	0.1535	8
Irrigated Maize	0.7018	11	0.2529	10
Beans	0.8956	12	0.2010	9

domestically. On the other hand, dry land maize, suffers from comparative disadvantage (1.1407), therefore the system is costing the economy. Sorghum (0.4327), irrigated maize system (0.2529), beans (0.2010), and peanut (0.1535) have the least comparative advantage.

Conclusion

PAM has been used in the study to analyse the competitiveness and comparative advantage of various crops under small-scale irrigation and dry land farming systems in Limpopo Province using 2006/2007 production data. The efficiencies of all irrigated systems were better than the dry land systems only in their social profitability. In terms of private profitability, the dry land systems were more efficient than some irrigation systems. However high value crops such as potatoes, tomatoes and cabbage production systems were more privately and socially efficient more than field crops such as maize, peanut and beans production systems. Therefore in other to increase the competitiveness of small-scale irrigators to the Limpopo Province on the revitalized schemes, emphasis should be placed in the production of these vegetables.

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