The Competitiveness and Comparative Advantage of Zimbabwe's Fertilizer Industry in Producing Compound and Phosphate Fertilizers

V Muringai, R Mano, L Rugube,R Foti, M Mutenje, HT Mahaka

Abstract

A study was carried out in 2004 to investigate Zimbabwe's competitiveness and comparative advantage in fertilizer production using gross margins, competitive advantage ratios and domestic resource cost ratios. Secondary data were used in the analysis. Gross margins for all fertilizers were positive indicating that it is privately profitable to produce compound and phosphate fertilizers. Competitive advantage ratios were all less than 1 showing that the industry is competitive in fertilizer production. Using a shadow exchange rate of US$1 = Z$6000.00, domestic resources cost ratios were all less than 1indicating that the country has comparative advantage in fertilizer production. It was also noted that the country's comparative advantage is influenced by the exchange rate used, with a weakening of the local currency having an increase in comparative advantage.

Key words: competitiveness, profitability, fertilizers, liberalisation and comparative advantage

Background

The fertilizer industry is strategic to the Zimbabwe's economy and agriculture in particular. Empirical evidence indicates that approximately 30% of the increase in food crop yield in developing market economies in the 1980s was brought about by increased fertilizer use (FAO, 1999). Because of this, policy makers have long viewed access to fertilizers as being critical to poverty alleviation and realisation of economic growth.

Before the liberalisation of the fertilizer industry in 1991, four companies were involved in the production of fertilizers (Zimbabwe Fertilizer Company (ZFC), Windmill Private Limited, Zimbabwe Phosphate Industries and Sable Chemicals). Liberalisation was aimed at improving efficiency in fertilizer production, product diversification and supply of fertilizers to farmers at lower prices. As a result new players (Omnia, Nutrichem and Farmers World) joined the industry and they are involved in the importation of straight fertilizers, which are used to produce blends (Competition and tariff Commission, 2003). Locally produced fertilizers are now competing with imports.

The production and exportation of fertilizers is guided by international differences in costs of production and product prices measured in terms of competitiveness and comparative advantage. Competitiveness is key for any economic actor in the agricultural sector because it is the ability to earn profits and maintain market share (ICRA, 2005). Profitability is the most important element of competitiveness, as it relates benefits (revenues) and costs (expenditure), and productivity is the most important underlying factor. Anything that would increase profitability and productivity would therefore increase competitiveness. Competitiveness is crucial as globalisation of finance, policy reforms, privatisation and liberalization have worked together to create a rapidly changing competitive environment (Petit and Gynaegy, 1994).

A closely related concept to competitiveness is comparative advantage. Comparative advantage is the relative efficiency of domestic production of a commodity in comparison to competing commodities or trading partners (Kannapiran and Fleming, 1999). It is a framework that allows the analyst to determine the economic as opposed to financial profitability of an activity. The classical theory of comparative advantage was developed by Ricardo to assess the economic efficiency of resource allocation in the production of traded goods (Kanappiran and Fleming, 1999). The principle of comparative advantage provides an explanation of specialisation and gains from trade and viewed as a positive theory, yields predictions about the direction and terms of trade (Tweeten, 1989). If every country specialised in the production and exportation of goods which another country is a relatively high cost producer, both global welfare and welfare of each trading country would be enhanced. At the national level, comparative advantage shows the relative efficiency in production of commodities in terms of net foreign currency earnings.

The main sources of comparative advantage include comparatively higher productivity due to better technology and lower opportunity cost of domestic resources, comparatively greater endowment of a globally scarce resource and comparatively low value of domestic currency relative to currencies of trading partners (Monke and Pearson, 1989). Han (1991) expressed the view that international competitiveness depends heavily on the stability of the macroeconomic environment. Exchange and interest rates are important factors determining the price aspects of international competitiveness. Microeconomic factors that affect international competitiveness are the cost of production and quality of products. These factors are determined at the level of the firm and its plant where the actual strategic and production processes take place.

There is therefore, need to assess the Zimbabwe's competitive and comparative advantages in fertilizer production. Competitiveness is important for planning of research and development, to improve weak parts in the fertilizer chain and realize potential (ICRA, 2005). This is because research and development resources are often limited and should therefore be used wisely.

Where commodity systems are currently competitive, competitiveness analysis helps in identifying ways to sustain this. In cases where systems are not competitive, it helps in identifying ways to make the systems competitive. A commodity may be successful in a country because of government subsidies or import controls (quotas) or taxes (tariffs). Government subsidies reduce costs of inputs while import quotas and tariffs raise the price of the imported product or reduce the level of competition from outside.

In most cases the production and marketing of that product may be beneficial to producers, but not necessarily to society who bear the costs of subsidies through taxation and payment of higher prices for goods. This is why it is important to carry out comparative advantage analysis because it gives information on whether fertilizer production represent an efficient use of the country's scarce resources such as land, capital and foreign currency (ICRA, 2005). Government policy makers need to know whether the country's policies encourage efficient use of resources.

Methodology

Data Collection

The study focused on local fertilizer companies that produce phosphate and compound fertilizers. Data on the quantity of inputs needed for the production of a tonne of fertilizer, costs of inputs and prices of fertilizers was obtained from fertilizer companies and the Ministry of Industry and International Trade. Data on world prices of fertilizers was collected from fertilizer companies and the Internet.

Valuation of Outputs and Inputs

The first step in analysing whether Zimbabwe's competitiveness and comparative advantage in producing compound and phosphate fertilizers was the valuation of outputs and inputs that are needed for the production of these fertilizers. Private valuation was achieved by using market prices for both output and inputs.

Social valuation was based on transforming private prices to appropriate social prices. A social (economic) price is obtained after adjusting for distortions caused by policies. Social prices are used when market prices are felt to be poor estimates of economic values of commodities.

Social Valuation of Tradable Commodities

Tradable commodities include fertilizers, raw materials, coal and oil etc. For tradable commodities, social prices are equal to import parity prices in the case of importable commodities and export parity prices in the case of exportable commodities. An exchange rate of US$ 1 = Z$6000.00 was used for the computation of social prices This was the black market exchange rate that was used by suppliers to acquire inputs in 2004.

Table 1: Computation of the Social Price for Fertilizers

	Phosphate fertilizer	Compound fertilizers
Exchange rate US$/Z$	6000	6000
FOB US$ / t	390	240
FOB Z$ / t	2 350 000	1 440 000
Transport + handling costs Z$ / t	300 000	300 000
Social Price	2 650 000	1 740 000

The same process illustrated in Table 1 was used in the calculation of social prices for other tradable inputs.

Non Tradable Inputs or Domestic Resource Factors

For non-tradable inputs such as labour, water, land and capital, the social price is defined in terms of national income forgone by not employing the factor in its next best alternative activity in the domestic market (Morris, 1988). Theoretically, the opportunity cost of labour in the production of a commodity is its contribution at margin to production of next best alternative. The private price of labour in the production of phosphate fertilizer is Z$52 719.00. The social price of labour was assumed to be Z$30 000.00 because it was assumed that this labour is overpaid since the country has high unemployment. For the production of compound fertilizers, the shadow price of labour was assumed to be Z$25 000.00.

Analytical Tools

Gross Margins analysis

Gross margin analysis was used to analyse whether fertilizer production is privately profitable. Gross margins were obtained by subtracting total variable costs from total revenue. A positive gross margin showed that the enterprise is privately profitable. The return per dollar invested was used to show net returns from fertilizer production and was obtained by dividing gross margins by total variable costs.

Competitive Advantage Ratio

The competitive advantage ratio (CAR) was used to assess the country's competitiveness in fertilizer production. It is obtained as follows:

CAR= Cost of domestic resources at private prices/ Value added at private prices

A CAR less than 1 indicates that the country has competitive advantage in producing fertilizers while a CAR greater than 1 indicates that there is no competitive advantage in producing fertilizers

Domestic Resource Cost Ratio

The domestic resource cost ratio (DRC) was used to assess whether Zimbabwe has comparative advantage in fertilizer production. It was developed by Bruno and Kruger in 1966 and is a standard way of measuring national profitability in the context of import substitution or export gain (Masters, 1991).

DRC = Cost of domestic Resources at Social Prices/ Value added at Social Prices

$$= (\sum_r N_r X_{ri} / (PiQi-\sum_r R_j Q_{ji}) \quad (1)$$

Where: N_r: Opportunity cost of a unit of domestic factor of production of r.

X_{ri} : Quantity of factor r used in activity i

Qi : Quantity of tradable commodity i

R_j : Import or export parity price of tradable input j

Q_{ji} : Quantity of tradable input j used in activity or crop i

A DRC less than 1 indicates that the country has comparative advantage in producing fertilizers while a DRC greater than 1 indicates that there is no comparative advantage in producing fertilizers

Protection Coefficients

The nominal protection coefficient (NPC) was used to compare domestic and international prices adjusted for marketing costs and exchange rates. The NPC of a commodity is the ratio of private prices of a commodity to its social price. An NPC less than 1 indicates an implicit tax on production (subsidy in the case of inputs) and an NPC greater than 1 indicates implicit subsidy on production (implicit tax in the case of inputs).

The Effective protection coefficient (EPC) was used to show the net incentive effect of government policy. It is represented by the ratio of the value added at private price (revenue from sales of tradable outputs minus the cost of tradable inputs all valued at the private prices) to value added at the social price.An EPC which is equal to 1 implies that there are no effective transfers from fertizer companies through the output and input market (no net transfers). An EPC which is less than 1 indicates that there is net taxation of farmers through output and tradable input markets whilst an EPC greater than 1 means that there is a net subsidy.

Sensitivity analysis

Sensitivity analysis was used to assess the impact of the exchange rate on the country's comparative advantage in producing the various fertilizers. An overvalued currency contributes to a loss of competitiveness of tradables and a contraction of the non-tradable sector (Steinherr, 1985).

Results and Discussion

Gross Margin Analysis

For all fertilizers, gross margins are positive (Table 2). This implies that phosphate and compound fertilizer production is privately profitable. Compound J has the highest gross margin due to a relatively high price and lower production costs. It has the highest price because it is used on high value crops such as horticultural crops. Compound S has the lowest gross margin. This is due to the fact that it has the highest cost of production. Compound S has the highest amount of triple super phosphate while Compound J has the least.

Table 2: Gross margins for phosphate and compound fertilizers

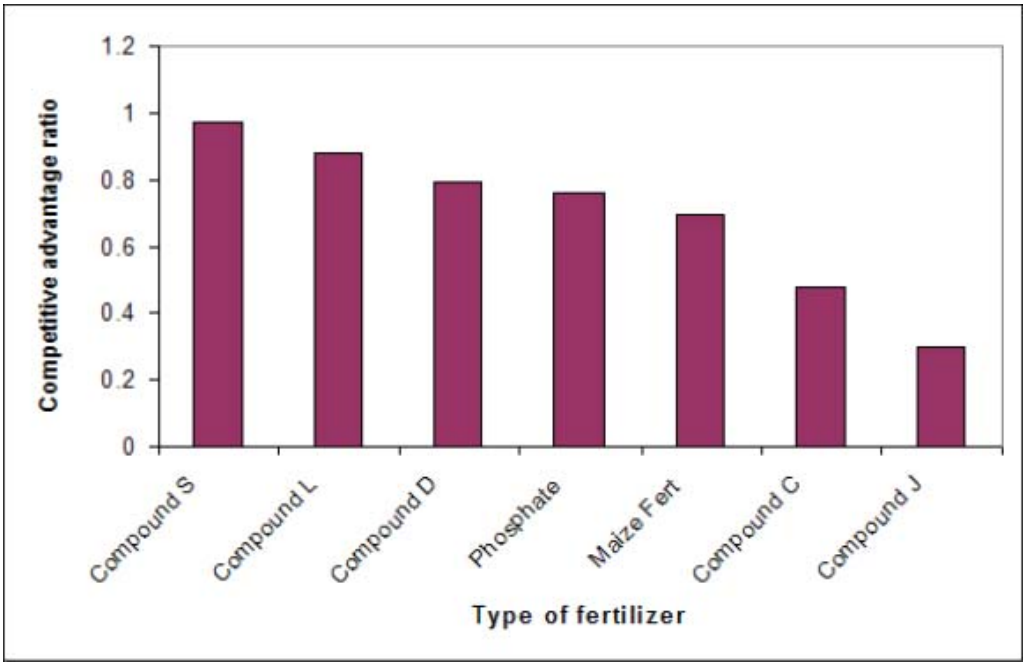
Type of fertilizer	Total revenue/ tonne	Total variable costs	Gross margin	Return per dollar variable cost
Phosphate	1194000.00	649740.00	544260.00	0.84
Compound J	329068.79	179418.37	149650.42	0.83
Compound C	350616.12	273618.79	76997.33	0.28
Maize Fert	295033.33	252014.59	43018.74	0.17
Compound D	270733.73	236983.60	33750.13	0.14
Compound L	278242.97	250685.91	27557.06	0.11
Compound S	330058.83	298240.19	20828.60	0.07

The return per dollar invested was used to show net returns in fertilizer production. For all fertilizers, the return per dollar invested is less than 1 (Table 1). If we look at the money market, the interest rate was more than 200 percent by the time the research was conducted. If fertilizer companies would opt to invest their money in the money market, for example, returns would be greater than 2, making fertilizer production less lucrative. However, it is important to note that fertilizer production is by nature a high volume, low return business. Considering these returns per dollar invested, fertilizer production is viable. Compound J has the highest return per dollar invested while Compound S has the least.

Competitive Advantage Assessment

Competitive advantage ratios for all the fertilizers are less than 1 (Fig 2) indicating that the country has competitive advantage in producing compound and phosphate fertilizers. Therefore, local firms can compete internationally in compound and phosphate fertilizer production.

Fig 2. Measures of Competitive Advantage for Various Fertilizers

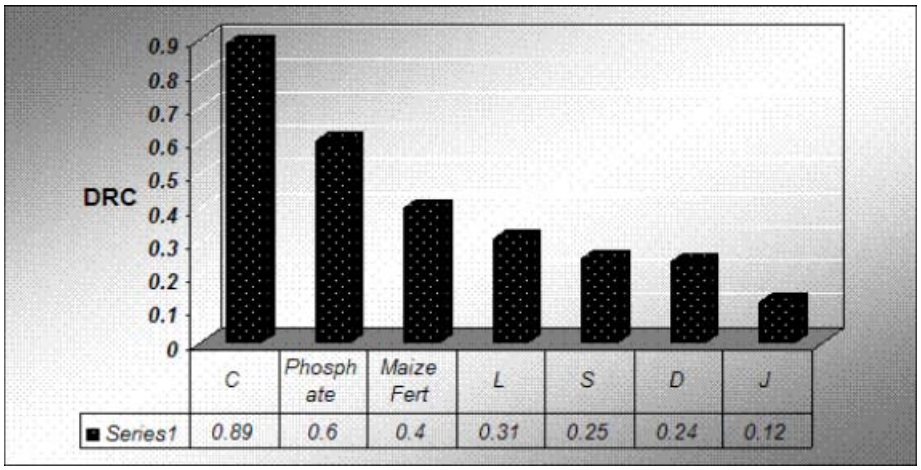


Comparative Advantage Assessment

The Domestic resource cost ratios for all compound and phosphate fertilizers are less than 1 (Fig 3). This shows that using a shadow exchange rate of US$1.00 to Z$6000.00, Zimbabwe has comparative advantage in producing phosphate and compound fertilizers. Production of compound and phosphate fertilizers in Zimbabwe is efficient because of the comparatively greater endowment of globally scarce factors of production. Most of the inputs that are used in manufacturingfertilizers are obtained locally. All the phosphate that is needed for manufacturing of compound fertilizers comes from Dorowa mine. Sable produces 70 percent of the country's ammonium nitrate requirements.

The country has comparatively higher productivity due to lower opportunity costs of domestic resources. This leads to lower DRCs, and thus a comparative advantage in fertilizer production. Zimbabwe might also have comparative advantage in fertilizer production due to the comparatively low value of domestic currency relative to those of trading partners.

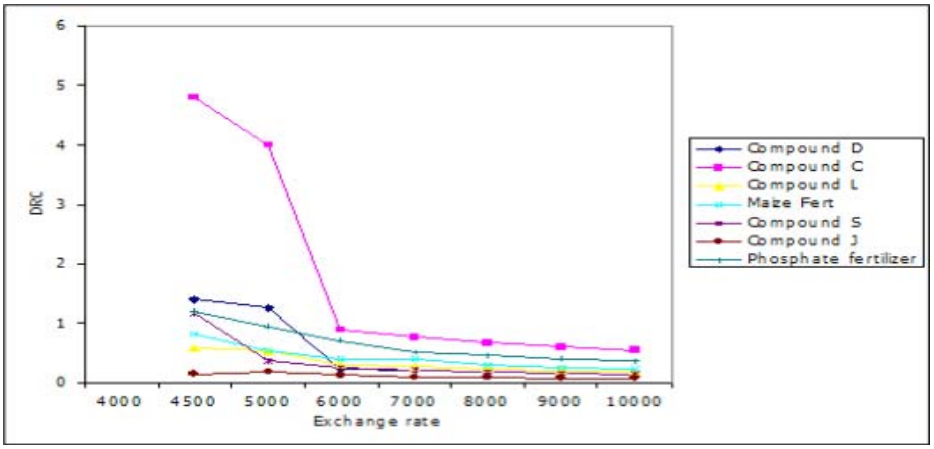
Fig 3. DRC Measure of Comparative Advantage for Various Fertilizers



Impact of the Exchange Rate on Comparative Advantage

Higher exchange rates are associated with lower DRCs whilst lower exchange rates are associated with higher DRCs (Fig 4). For example, if we look at Compound D, use of an exchange rate of US$1.00 = Z$10000.00, the country has a greater comparative advantage. However, if we use an exchange rate of US$1.00 = Z$5000.00, Zimbabwe loses its comparative advantage in the production of Compound D and C. This shows that the exchange rate used has an impact on the DRC. It therefore implies that compared to a controlled exchange rate, Zimbabwe has greater comparative advantage with a liberalised exchange rate. However, if we increase the exchange rate to US$1.00 = Z$6000.00, Zimbabwe will have comparative advantage in producing all compound and phosphate fertilizers.

Fig 4. Comparative Advantage Analysis Using Different Exchange Rates



The other interesting observation is that the DRC for Compound C is very responsive to the exchange rate used. Fertilizer companies have no comparative advantage in producing Compound C at any exchange rate that is below US$1.00 = Z$ 6050.00.

Protection Coefficients

NPCs for both output and tradable inputs are less than 1 (Table 3). This shows that fertilizer companies are being implicitly taxed for fertilizers and implicitly subsidised for tradable inputs. Fertilizer prices are far below those on the world market. The average price of fertilizer on the world market is over US$240.00 per tonne while the regional price of fertilizer is above US$400.00 per tonne (Rugube, 2003). Prices of fertilizer in Zimbabwe are between US$60.00 and US$120.00 per tonne. Companies are paying less than what they ought to pay for tradable inputs such as ammonium nitrate, triple super phosphates, talc and oil.

The EPC was calculated in order to show the net incentive of government policy. EPCs for Compound D, Compound L, Compound S, Compound J and phosphate fertilizer are less than 1. There is therefore net taxation in manufacturing these fertilizers. The EPC for Compound C is greater than 1 (1.23), implying a net subsidy in its production.

Table 3. Results on Protection Coefficients

	NPC for output	**NPC for tradable inputs**	**EPC**
Compound D	0.16	0.14	0.20
Compound C	0.20	0.15	1.23
Compound L	0.16	0.15	0.24
Maize Fert	0.17	0.14	0.38
Compound S	0.19	0.19	0.17
Compound J	0.19	0.14	0.26
Phosphate	0.45	0.41	0.47

Conclusion

Production of phosphate and compound fertilizers is a viable business though it has low returns. Zimbabwe is competitive and has comparative advantage in producing compound and phosphate fertilizer companies.. The exchange rate used has an impact on the DRC. From the study, it is recommended that the Zimbabwe produce phosphate and compound fertilizers because the business is profitable and the country has comparative advantage in their production. But however, the question that arises that why is Zimbabwe an importer of these fertilizers whilst the country can produce these fertilisers competitively and efficiently.

References

.FAO, 1999. **A Fertilizer Strategy for Zimbabwe.** FAO Publications. Rome. Italy.

Competition and Tariff Commision, 2003. **Report on Investigation into Allegations Restrictive Practices in the Zimbabwean Fertilizer Industry. Report No. 5.** Unpublished.

Han, S.S. 1991. '**Public sector / Private Sector Interface in international Competitiveness: Interaction of the Public and private sectors,** EDI Seminar Series, World Bank, Washington D.C.

ICRA, 2005. **Competitiveness and Comparative Advantage- Key Concepts**

www.icra-edu.org/objects/anglolearn/ACF0LyIyI.pdf - 182k

Kannapiran C.A and E.M Fleming, 1999. **Competitiveness and Comparative Advantage of Tree Crop Smallholdings in Papua New Guines.** No. 99-10. Working Paper series in Agricultural and resource Economics. University of New England.

Masters, A. 1991. **Comparative Advantage and Government Policy in Zimbabwean Agriculture.** A Dissertation Submitted to the Food Research Institute and the Committee on Graduate Studies of Stanford University.

Monke, E.A. and Pearson S.R, 1989. **The Policy Analysis Matrix for Agricultural Development.** Cornell University Press. Ithaca.

Morris L. 1988. **Economics of Fertilizer Application**. CYMMT Economics Working papers.

Petit M and S Gynaegy, 1994. **Agricultural competitiveness and Global Trade. Looking at the Future of Agriculture Through a Crystal ball.** (2) International Conference for Agricultural economists. August 22-24, 1994. Harare. Zimbabwe.

Rugube L, 2003. **Fertilizer Industry in Zimbabwe.** Unpublished.

Sellen D, 1993. **Economic Reform and Agricultural Sector Policy in Zimbabwe: Case Studies in Policy Analysis.** EDI Working Papers.

Steinherr, A. 1985. **Competitiveness and Exchange Rates.** North- Holland, Amsterdam.

Tweeten, 1989. **Agricultural Policy Analysis Tools For Economic Development.** IT Publications. London.

Warr, P.G 1994. **Comparative and Competitive Advantage.** Asia- pacific Economic Literature 8 (2), 1-14.