AN ANALYSIS OF THE COMPARATIVE ADVANTAGE AND POLICY INCENTIVES OF COMMERCIAL WHEAT PRODUCTION IN SOUTH AFRICA

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Despite the fact that all direct and indirect measures of subsidisation and protection have been removed, commercial agriculture is still widely considered to be subsidised, privileged and uncompetitive. This paper shows how the process of deregulation has in fact changed the situation. The paper reports on the comparative advantage in the production of wheat in South Africa and reveals the various distortionary effects, if any, of the policy environment on the production of wheat in the country prior to 1997. The paper concludes that South Africa has a strong comparative advantage in the production of wheat, especially, in the inland areas. Favourable climatic and soil factors as well as abundant and relatively cheaper domestic factors of production may be some of the reasons for this strong comparative advantage. The inland areas have better RCRs due to higher inland transportation costs. However, wheat production under irrigation seems to have no comparative advantage. This is mainly due to the implicit subsidy on irrigation water.

1. INTRODUCTION

Many studies of agricultural protectionism (e.g. Anderson & Hayami, 1986; Parikh *et al*., 1987; Krueger *et al*., 1988; Webb *et al*., 1990; Lindert, 1991 and Vink, 1993) have revealed a fairly consistent pattern of protection across countries and time. Such protection of agricultural producers have severely distorted national and international resource use, as well as agricultural markets and trade, particularly in the developed countries (Goldin & Knudsen, 1990). The protection usually creates a wedge between market (private) prices of commodities and their economic (social) prices. But whenever discrepancies exist between private and social prices, the interest of the farmers and that of the state diverge. On the one hand, a crop can be profitable to farmers (e.g. because of input or output subsidies), but its production may not represent efficient use of resources from the point of view of the nation. On the other hand, a crop can be unprofitable to farmers (e.g. due to taxes imposed on output or input prices), however its production may represent an efficient use of the nation's resources.

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Like most countries of the world, South Africa's agriculture has had a long history of ever increasing government intervention. In the past, South African producers of agricultural and food products, operated within a highly protected environment, supported by statutory intervention measures that were argued to be harmful both in terms of efficiency and equity.

As a result of all these policy measures large-scale commercial (mainly white) producers were considered to be highly protected, inefficient and subsidised. However, as a result of deregulation since the 1980s, the general movement towards freer markets, the introduction of tariffs and the removal of quantitative controls the agricultural scene in South Africa has changed considerably. Despite the fact that all direct and indirect measures of subsidisation and protection have been removed, commercial agriculture is still widely considered to be subsidised, privileged and uncompetitive. This paper intends to show how the process of deregulation has in fact changed the situation. For this reason the paper reports on the comparative advantage in the production of wheat in South Africa and reveals the various distortionary effects, if any, of the policy environment prior to 1997 on the production of wheat in the country.

Some studies (*cf.* Kleynhans & Street, 1997) have compared yields and production costs of wheat in South Africa with that of other major wheat producing countries. None has however done an analysis of the comparative advantage of domestic wheat production, which is a sounder basis for assessing the international competitiveness of an industry. This paper ads to these studies by analysing the comparative advantage of the wheat industry in some of the inland producing regions before the recent change in marketing arrangements. Interpretation of the results should therefore be done in the context of the old marketing dispensation.

2. THE DOMESTIC MARKETING AND PRICING POLICY OF WHEAT PRIOR TO 1997

In South Africa, wheat is grown mainly for human consumption, however, small amounts of wheat not fit for milling purposes are marketed as stockfeed (Agrocon, 1994 and Sartorius Von Bach & Van Zyl, 1994). Wheat plays only a secondary role in South African field crop production and trade (Otto, 1990 and Agrocon, 1996). South Africa has traditionally been a deficit producer and thus an importer of wheat (Agrocon, 1996). But from the 1970's production gradually overtook local consumption in certain years with the result that South Africa began exporting some small quantities of wheat (Otto, 1990).

Up to the recent abolishment of the Winter Grain Marketing Scheme, the Wheat Board has been operating a single channel marketing system in which case the Wheat Board was the sole buyer and seller of wheat in the country. In the past (before the 1994/95 marketing season), the prices of wheat were set by the Wheat Board and approved by the Minister of Agriculture. During the 1996/97 marketing year, wheat in South Africa was sold at a "negotiated" price which was determined by a negotiated team consisting of the producers and buyers (millers) (Agrocon, 1996). Such prices on which the negotiating team has reached consensus are no longer sent to the Minister or the Wheat Board for approval but are merely submitted for notification. The producers' negotiation team consists of representatives from each wheat producing region whilst the buyers are made up of representatives from each of the six major milling groups in the country together with representatives from the small millers.

During the negotiation process, certain important factors are taken into consideration before consensus is reached. These include the following: International export prices for wheat, levels and trends of price increases for wheat and wheaten products, the impact of wheat price increases on bread price and bread consumption, international production, the Consumer Price Index (CPI) for food, the producer price index (PPI), consumption and trade statistics for wheat, etc. (Agrocon, 1996).

3. POLICIES RELATED TO AGRICULTURAL INPUTS AND RESOURCES

The comparative advantage position of agricultural commodities is also influenced by government policies related to agricultural inputs and resources such as capital, land, water and labour. Distortive policies on agricultural inputs include value-added tax and import tariffs on imported inputs. The domestic input industry in South Africa is protected on a wide range of tariff lines related to agricultural inputs.

Within the land and labour market no policies are affecting the working of the market and land prices and wage rates could therefore be considered a true reflection of the economic costs of resources. Irrigated agriculture has, however, the benefit of water being subsidised. This is mainly as a result of the pricing structure not taking into account the capital and full delivery costs in irrigation schemes.

Previously farmers had access to a wide range of subsidised loans provided by a range of government or semi-government institutions. Some of these

institutions have now been phased out while others are charging market related interest rates. Co-operatives and commercial banks supply more than 70% of all farm credit in South Africa. Their rates to farmers are often a few percentage points higher than the prime banking rate, indicating that farmers are not benefiting from or taxed by any government policy in this market.

4. METHODODOLOGICAL ASPECTS OF COMPARATIVE ADVANTAGE ANALYSIS

To be able to know whether it is profitable - financially or economically - to produce an agricultural commodity in any part of the country requires proper analysis of the production process and marketing of that commodity. The production analysis will involve analysing critically the input requirements of the production process as well as the output that will be generated. By applying social or economic analysis, it will be possible to determine whether the scarce resources of the country for agricultural production are used efficiently. In addition to this, it will also be possible to determine whether the government's agricultural policies are correct and not leading to inefficient allocation of resources.

In a world of trade restrictions and distorted exchange rates leading to distorted prices and unrealistic investment decisions by governments, considerable effort was spent on devising frameworks which could be analytically satisfactory and at the same time practically useful for the measurement of the opportunity cost of producing or saving foreign exchange as well as for the measurement of the economic cost of various restrictive systems. Among such frameworks developed was Domestic Resource Cost (DRC) analysis.

The concept of DRC relates to a measure of real opportunity cost in terms of total domestic resources of producing (or saving) a net marginal unit of foreign exchange (Bruno, 1972). The DRC method generates several measures of relative economic efficiency of production alternatives. It is used as an *ex ante* measure of comparative advantage to determine which, amongst a set of alternative production activities, is relatively efficient for a given country or region in terms of contribution to national income (Bruno, 1972).

The domestic resource cost method has a long history of practical use. Government planners applied it quite extensively in Israel in the early 1950s as a means of project evaluation (Bruno 1972), as well as in Turkey as a policy-analysis measure (Krueger, 1966; 1972). It was soon widely adopted by agricultural-sector studies (e.g. Pearson & Meyer, 1974; Jansen and Hayes

1995), and still remains the dominant measure of comparative advantage in numerous World Bank and USAID sector studies (e.g. World Bank, 1991), as well as studies done by CYMMIT (Morris, 1990), the FAO (Appleyard, 1987), IFPRI (Gonzalez *et al.*, 1993), USAID maize production studies in Zimbabwe (Masters, 1994), cotton production studies in Georgia, USA (Shurley, 1992), and others.

In this paper we use a variant of the DRC, namely the resource cost ratio (RCR). The RCR of a particular commodity is calculated by dividing production inputs and outputs into tradables and non-tradables and expressing the net value of non-tradable as a proportion of the value added to tradables. Using data from enterprise budgets, the RCRs can be calculated using the following formula (Masters, 1995 and Jansen & Hayes, 1995):

$$RCR_X = \Sigma(P_j^* Q_j) / (P_X^* Q_X - \Sigma P_i^* Q_i)$$

where:

RCR_x = resource cost ratio for crop "x"
P_j^* = social price (shadow price) of primary factors of production
Q_j = quantity of primary factors of production used (per ha)
P_x^* = social price for crop "x"
Q_x = quantity of crop "x" produced (per ha)
P_i^* = social prices (shadow prices) of tradable production inputs
Q_i = quantity of tradable production inputs used (per ha)

Table 1: Interpretation of RCRs

Value of RCR	Interpretation
0<RCR<1	Value of domestic resources used in production is less than value of foreign exchange earned or saved => Comparative advantage
RCR>1	Value of domestic resources used in production exceeds the value of foreign exchange earned/saved => No comparative advantage
RCR<0	More foreign exchange used in the production of the commodity than what the commodity is worth => No comparative advantage

The DRC ratios and RCR use the same formula as indicated above. The only difference is that in the RCR equation, both the numerator and the denominator are expressed in the same currency units. Since these results are based on a partial equilibrium methodology, and assumption of constant prices, their validity should be further tested under conditions that deviate from the basic assumption of the DRC framework.

Sensitivity analysis was therefore conducted to determine whether the comparative advantage rankings are sensitive to changes in the individual parameters. This is important because technical coefficients used in constructing the enterprise budgets (e.g. yield, use of inputs) are often mean values calculated from a range of observed values.

The major difficulty with using the DRC method arises in valuing inputs and outputs. This is particularly so when choosing the appropriate opportunity cost of non-traded primary factors such as land, labour, capital and water, especially when no market for such factors exists. In the same way, prices of tradables often do not correspond to their true economic value because market imperfections and government intervention to control prices and ration the distribution of goods result in distorted prices (Rashid & Hamid, 1995).

To make the sources of an activity's comparative advantage fully explicit, Monke & Pearson (1989) devised the Policy Analysis Matrix (PAM) which will be used in this analysis. The PAM is essentially, a product of two accounting identities. The first defines "profitability" as the difference between revenues and costs. The other measures the effects of government intervention or divergences (market failures) as the difference between observed parameters and parameters that would exist if the divergences were removed. By filling the elements of the PAM for an agricultural activity, it would be possible to measure the extent of policy effects and the inherent economic efficiency (or comparative advantage) of the activity. Most of the measures of comparative advantage discussed earlier, such as the RCR, can therefore be calculated from the policy analysis matrix.

5. RESULTS FROM THE COMPARATIVE ADVANTAGE ANALYSES

Different Policy Analysis Matrices (PAMs) were constructed for wheat production in 5 districts namely, Bergville, Bethlehem, Douglas, Brits and Ventersdorp. The various indicators of comparative advantage and policy incentives and social and private profitabilities, input and output transfers and net policy effects were calculated from the PAMs.

The analyses involved only large scale, capital-intensive production processes. The data used for the analyses were based on the COMBUD enterprise budgets from the Directorate of Agricultural Economics, as well as information obtained from other sources such as the Wheat Board, Department of Water Affairs, etc. The information from the latter sources was used to improve the quality of the COMBUD budgets since production costs are sometimes inflated. The budgets were adjusted in a number of areas. For example fixed input costs were added to the normal gross margin analyses.

The analyses indicate that the computed RCRs for all the districts are positive and less than 1, all the RCRs have values ranging from 0.20 to 0.93 (See Table 2). These values, therefore, indicate comparative advantage for wheat production in the country, especially under dryland. It seems however, that wheat production under irrigation does not have comparative advantage. The profitability values also indicate net gains to the country and the farmers when resources are committed in the production of wheat. The results show that wheat production under irrigation yield higher private profits due to the subsidy on irrigation water even though the profits are still low.

Table 2: Indicators of comparative advantage and policy incentives for the production of wheat in some districts in South Africa, 1994/95

District	RCR	Output Transfer (R)	Social Profitability (R)	Subsidy ratio to producers
Brits (Irrigation)	0.93	-1362.10	226.05	0.021
Bethlehem (Dryland)	0.20	-517.80	1107.28	-0.313
Douglas (Irrigation)	0.79	-1822.15	1051.99	0.017
Ventersdorp (Irrigation)	0.99	-1123.63	8.43	0.106
Bergville (Irrigation)	0.91	-1456.98	392.54	0.188
Bergville (Dryland)	0.36	-485.66.	755.03	-0.317

Due to the high economic cost of water, production under irrigation has lower social profits. This means when farmers are made to pay the true cost of irrigation water, they may not get the profit they use to get. Some may even produce at a loss. Therefore wheat production under irrigation may not be the best utilisation of agricultural resources.

The analyses also show variations in the profitabilities - both social and private - for the various areas. Obviously different soil types, different climatic conditions and differences in production costs can be cited as some of

the causes for this trend. However, in addition to these, transportation costs equally play an important role.

The results also indicate that, with the exception of the domestic factor transfers, all the policies that affect the production and marketing of wheat are disincentives to the dryland wheat farmers whilst the irrigation farmers experience positive domestic factor transfers and net policy effects. The actual policy that led to this situation, are taxes on the revenue as well as on tradable inputs. A combination of low producer prices and high production input prices, in many instances, can never lead to profit making.

6. SENSITIVITY ANALYSIS

The values of the RCRs from the various analyses indicate comparative advantage for the production of both maize and wheat. However, the PAM is a static model and cannot capture the potential changes in prices and productivity. This means the results (RCRs) are subject to change as a result of changes in market conditions. Sensitivity analysis is therefore necessary to determine the robustness of the RCRs against price and yield changes.

The value of the South African Rand has fallen against the major currencies of the world and this has led to increase in the exchange rate between the Rand and the U.S. Dollar. It was therefore assumed that any possible fall in the world prices of maize and/or wheat will be compensated for by the higher exchange rate. This may, however, be an unrealistic assumption. Increase in the world prices of the commodities, coupled with the higher exchange rate *ceteris paribus*, will lead to better RCRs. Even when prices of the commodities on the world market drop, the higher exchange rate will result in favourable RCRs. Therefore the base year prices for both wheat and maize were maintained in the sensitivity analyses.

The results of sensitivity analysis for wheat are interesting. Wheat production under irrigation already has high and unfavourable RCRs. An increase in the input prices therefore caused a shift in their comparative advantage positions to a situation where none of the producing regions has a comparative advantage.

When wheat yields are reduced by 20 percent, all production under irrigation loose their comparative advantage but it will still be economically efficient to produce under dryland. On the other hand, if the yields are reduced by 50 percent, only dryland production in Bethlehem will have a comparative advantage.

Table 3: Sensitivity analysis on RCRs for wheat production

	Bergville (irr)	Bergville (dry)	Bethlehem (dry)	Douglas (irr)	Ventersdorp (irr)	Brits (irr)
Base scenario:	0.91	0.36	0.20	0.58	0.99	0.93
Single input price changes:						
(1) Prices of fertilisers up by 20%	0.93	0.38	0.21	0.78	1.02	0.95
(2) Prices of chemicals up by 20%	0.91	0.38	0.21	0.76	1.00	0.94
(3) Interest rate up by 50%	0.94	0.40	0.25	0.76	1.10	0.94
(4) Water cost up by 50%	0.96	-	-	0.86	1.28	1.04
(5) Cost of land up by 100%	0.96	0.44	0.24	0.79	1.05	0.97
(6) Cost of labour up by 100%	0.94	0.38	0.22	0.76	1.02	1.02
Multi-input price changes:						
(7) Prices for chemicals and fertilisers up by 20%	0.93	0.39	0.22	0.79	1.03	0.97
(8) Cost of labour and land up by 100%, interest rate up by 50%	1.00	0.48	0.28	0.82	1.10	1.20
(9) Cost of labour and land up by 100%, interest rate up by 50%, chemicals and fertiliser costs up by 20%	1.02	0.51	0.30	0.86	1.13	1.26
Yield changes						
(10) Yield reduced by 20%	1.28	0.55	0.29	1.05	1.23	1.37
(11) Yield reduced by 50%	3.23	1.55	0.78	2.70	4.27	4.91

9. CONCLUSIONS

This study has evaluated the policy distortions and comparative advantage of wheat production in South Africa using the Policy Analysis Matrix (PAM). The PAM is an effective tool to show the distorting effects arising from various policy instruments. It provides a framework to measure the costs and benefits of those policy instruments to various interest groups.

The analyses have shown that the country has strong comparative advantage in the production of wheat, especially, in the inland areas. This is indicated by the RCRs and the social profitability analyses. Favourable climatic and soil factors as well as abundant and relatively cheaper domestic factors of production may be some of the reasons for this strong comparative advantage. However, the high world prices for wheat during 1996 also contributed to the strong comparative advantage of domestic wheat production. The inland areas have better RCRs due to higher inland transportation costs. The higher transportation costs resulted in higher import parity prices, which resulted in lower RCRs. However the net policy effect measures show that wheat farmers are taxed either through lower produce prices and/or higher costs of tradable production inputs. (Since all the farm systems analysed were large-scale, capital intensive, the cost component of the domestic factors of production is relatively small). This resulted in the farmers getting sub-normal profits as confirmed by the negative tradable input transfers. The net policy effects show that there is rather a transfer of income from the farmers to the state. This is even manifested in the higher social profits as compared to the private profits for the farmers who produce under dryland. The irrigation farmers experience positive net policy effects mainly due to the subsidy on irrigation water. The situation may change if they pay the true cost of water.

The higher import parity prices imply that it will not be economically efficient to import wheat. It may be argued that the imported commodities can be used in the coastal areas. However, dependence on imports will not lead to food security but will rather make the country vulnerable to external pressures and falling exchange rates.

Currently, South Africa is a net importer of wheat. However, the analyses have shown that the country has a comparative advantage in producing wheat in the areas included in the study. This means the importation of wheat into the country can be reversed if local production is stepped up, especially in those areas, which are far from the coast and therefore have high domestic transportation costs and therefore higher import parity prices. In a

perfect economy, the value of an output is determined by the prevailing "undistorted" market price. Therefore the only factor that can cause the local producer price of wheat to depart from the world price is transportation costs.

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