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THE ECONOMICS OF GRAIN WAREHOUSING IN SUB-SAHARAN AFRICA

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ABSTRACT

Efficient "public" and third party warehousing services potentially have an important role to play in enhancing the performance of agriculture in Africa. This paper reports on research into the economics of warehousing of cereals in Ghana and Zambia, and draws implications for such services in Africa as a whole.

Due to under-developed links between trading and financial sectors, and to speculative risks, very high levels of profit can currently be earned from intra-seasonal storage of grains in both countries. Nonetheless, it is difficult to establish public warehousing services in grain producing areas, because of the risk of low capacity utilisation and high unit overheads. Such services can only be profitable if combined with other profitable activities, e.g. trading, collateral management, freight forwarding or brokerage.

1. INTRODUCTION

In developing and former socialist countries, commercial warehousing and warehouse receipt financing (or "inventory credit") can play an important part in creating efficient markets (Coulter and Shepherd, 1995, Anon, 1996, Lacroix and Varangis, 1996). Warehouse operators can ensure the integrity and quality of stocks involved in transactions, and acting as "collateral managers", provide the banks with security for loan collateral. This helps break down the barriers between banks and indigenous farming and trading sectors, increases trade liquidity and thereby smooths intra-seasonal price fluctuations.

This paper is principally concerned with of "public" and "third party" warehousing. A public warehouse provides services to the public in general, whereas a third-party warehouseman may only provide services on a one-to-one arrangement with selected clients.

In Africa, warehousing is of particular interest because of the abundance of warehouses built with donor funding for grain parastatal enterprises and state-controlled co-operatives. Zambia and Tanzania both have around a million tonnes of capacity in stores of this kind. Market liberalisation has caused these facilities to be generally underutilised, since farmers have assumed much of the State's former role in intra-seasonal storage of grain, releasing grain onto the market more gradually than before. While an increase in on-farm storage is a desirable development, more off-farm storage is also needed in order to facilitate transactions and to smooth price fluctuations. One therefore needs to find ways of structuring services which will allow former State warehouses to be used more effectively in support of private off-farm storage.

Our current research[2] seeks to identify optimal design features for warehousing services in the African context. The economic analysis presented here are the findings of the first part of this research

The intra-seasonal storage of foodgrains is examined within the wider context of warehousing services in general, whether for foodgrains, cash crops or non-food products, Warehousing services are normally most developed in port areas, involving both bonded and non-bonded cargo entering international trade[3]. Warehousing skills developed in this environment are largely transferable to up-country storage situations, and while the latter have tended to be a preserve for parastatal enterprises, port or urban warehousing concerns may get involved in the future.

The study involved two main parts.

Firstly, a spreadsheet model was developed to assess the profitability of intra-seasonal storage of maize in Ghana and Zambia (see Appendix 1 for the

[2] Funded by the DFID Crop-Post Harvest Research Programme.
[3] Bonded warehouses are those in which goods are held subject to the payment of tariffs, taxes or other duties.

methodology).

Secondly, field-studies were carried out in the same two countries, involving:

- the collection of information on the organisation and economics of such warehousing services as exist;
- the analysis of demand for warehousing services, and;
- the production of financial profiles for public warehousing operations which might conceivably be established in the future.

Field studies were carried out by multi-disciplinary teams including an economist, a warehousing consultant (the Managing Director of a public warehousing company in Kenya), a grain storage technologist and local participants involved in grain trading and storage businesses (see Coulter *et al.*, 1996 and 1997).

This paper reviews the findings of the above, formulates general conclusions about the economics of warehousing in Africa, and draws implications about the way in which such services may best be organised in the future. The authors also draw upon experiences in other countries, notably Mozambique (Coulter and Sondhi, 1996), and Kenya

2. MAIZE PRODUCTION AND STORAGE IN GHANA AND ZAMBIA

There are many differences in the circumstances of the two countries studied.

Zambia's rainfall pattern is unimodal and most maize is left in the field to dry before harvesting. By contrast, in the key surplus-producing areas of south-central Ghana rainfall is bimodal and there are two crops. As the crop must be harvested wet, storage represents more of a problem for farmers, particularly when quantities are large.

Zambia has major over-capacity in warehousing, with publicly-owned facilities sufficient for 900,000 tonnes of maize. Ghana has more moderate storage capacity, though here too donors have equipped the country with a network of parastatal sites, including drying facilities, with usable storage capacity of around 30,000 tonnes.

Zambia and Ghana have different histories of Government involvement in maize marketing. Until the beginning of the 1990s, Zambia had a single-channel State-controlled system, whereas in Ghana, the parastatal never marketed more than 10% of the country's marketed surplus. Since liberalisation however, Zambia's grain trade has attracted much more international capital than has Ghana, and a significant part of the crop has been marketed by international commodity traders working with local companies[4]. Most of Ghana's trade is carried out by a myriad of small

[4] Nonetheless, international traders' involvement in Zambia has been minimal in comparison to their involvement in South Africa, as they have they have seen it as a small, high risk, high margin market. Regarding risk, there has been

informal traders, each of them moving an insignificant portion of the crop. No Ghanaian grain trader markets as much as 10,000 tonnes of domestic grain a year, but there are at least two Zambian traders who move 50,000 tonnes or more of domestically produced maize, soybeans and wheat.

At the consumer end of the market chain, Zambia has industrial mills which together use upwards of 200,000 tonnes per annum of maize. Ghana has no such milling industry, and the total consumption of larger users, including feed-millers, commercial poultry farmers, brewers and food processors, is estimated at around 50,000 tonnes.

Zambia is landlocked and experiences larger price swings depending on the surplus and deficit situation in Zambia and the surrounding region. The deficit scenario is illustrated by 1995/96, when wholesale maize prices spiralled up to import parity levels of US$ 300 per tonne and more. The surplus scenario was illustrated by 1996/97, when prices in the region fell back towards export parity. Price fluctuations were accentuated by unusually large changes in world market prices, reflected in the price for US No.2 yellow maize. This rose to a peak of US$ 204 per tonne delivered to US Gulf ports in May 1996, only to fall to $118 per tonne, a price close to historical averages, by December of the same year (Food Outlook, FAO).

3. ANALYSIS OF PRICE VARIABILITY

Both countries are characterised by a very high level of *intra-seasonal price variability.* In the case of Ghana, this can be seen from Figures 1 and 2 which show how monthly spot prices (in constant US$ terms) have varied in a major surplus market over the ten years to 1995/96. Prices usually bottom out in September and October, and peak in May and June, there typically being at least a 100% price increase in real terms over this eight month period. Only in three out of ten years were increases less than this.

In Zambia, a seasonal price pattern has emerged in the four years during which Government has been largely absent from the market (see Figure 3). In three of these years, prices increase slowly from mid-year to August, then rising faster and peaking around February, before falling in anticipation of the new harvest. The exception was 1996/97, when as noted above southern African was moving from surplus to deficit.

Wide intra-seasonal price variability is evidence of poor integration between the financial and agricultural markets, and insufficient competition in intra-seasonal storage. 1995/96 was a year of regional shortage in southern Africa and large price rises were foreseeable in Zambia; nevertheless prices only rose slowly towards the import-parity level. This is in complete contrast to

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widespread appreciation of the fragility of the consensus in favour of liberalisation, and fears of: (a) inconsistent application of policies by Government, and; (b) a reversal of policies towards historic interventionist postures. Since late 1997, these fears have been borne out by increasing public intervention in the importation of fertilisers and grains, activities which it had been intended to fully privatise.

most western countries and much of Asia where seasonal price spreads approximate storage costs. This is only partly due to Government intervention. In the West trade finance is more readily available, and the practice of forward and futures trading drives down the marginal returns to storage and enhances security for bank lending.

Price variability is also evidence of high risks, particularly in Zambia, where in 1996/97 some large traders experienced speculative losses. Risks are high because:

- It is difficult to predict supply and demand. This is due partly to the inherent nature of smallholder production and trading in Africa, since it is difficult to estimate quantities stored by hundreds of thousands of smallholders, or quantities being traded informally across borders. It is also due to institutional factors, e.g. poor crop forecasting, *ad hoc* market intervention by Government, discretionary rules concerning international trade.
- Limited use is made of risk management tools, e.g. forward contracting or hedging on international commodity exchanges. In Zambia, there is some forward selling between maize traders and large millers in Zambia, but geographical factors make futures markets largely inaccessible.

4. DEMAND FOR WAREHOUSING SERVICES

In Zambia, there seems to be considerable demand for third-party warehousing and related services in both surplus and deficit years, for storage of grain and fertiliser. Government and donors are the main clients for fertiliser storage, but the level of demand is difficult to predict from year to year. Government's Food Security Reserve is also likely to be a significant customer. In 1995/96, approaching 100,000 tonnes of maize were stored by third parties (Coulter *et al.,* 1996), but only a limited part of this was held by companies offering a public warehousing function, in all as an adjunct to trading businesses (in tobacco, cotton and grain) or inspection services. The bulk was held by local trading companies on behalf of larger international companies, or by Government-sponsored "credit co-ordinators" on behalf of farmers seeking to repay loans.

In Ghana demand for the storage of domestic produce is much smaller, but increased after 1993 due to the introduction of warehouse receipt financing and the changing role of the parastatal (GFDC), which begun to dry and store grain for private clients. The total quantity in third party storage rose to around 12,000 tonnes in 1995/96, and after a poor harvest in the following year, similar volumes were stored in 1997/98. However most maize continues to be stored on farms, and persistance of intra-seasonal price variability suggests that there is scope for much more commercial storage.

The main demand for storage in Ghana is for holding exported and imported commodities such as rice, sugar and coffee, some of them collaterally-managed under inventory credit arrangements, in and around the port of Tema.

5. THE QUALITY AND REPUTATION OF WAREHOUSE OPERATORS

In both countries the quality of warehousing is variable. In Zambia, there are shortcomings in record-keeping, accuracy of weighing, stacking, store hygiene, use of dunnage (pallets), pest control, and fire-safety arrangements. Notwithstanding, warehousing staff and managers are responsive to suggestions and willing to learn, so it is likely that training would have an immediate impact on the quality of services. In Ghana, there is a core of professional people involved in warehousing, and this was particularly evident in public sector stores. However, in the industry as a whole there is a need for training in storage and handling of goods, and for the standardisation of documentation and inventory control.

An enhancement of the reputation and performance of local warehousing companies could give them access to a greater share of trade-related collateral management business, and to new agricultural warehousing business in up-country areas. This could be done by a combination of training in warehouse operation and management, setting of industry-wide standards linked to an inspection system, and insurance cover to underwrite warehouse performance. One useful step to advance this process would be the establishment of local warehousing associations, which would in effect set minimum standards for accreditation of warehouse operators.

6. THE PROFITABILITY OF INTRA-SEASONAL STORAGE

The spreadsheet model analyses the economics of intra-seasonal storage by depositors, at three locations: Techiman (south-central Ghana), Tamale (northern Ghana) and Kabwe (Zambia). It is assumed that depositors finance their stored produce with a mixture of equity and debt capital, raising the debt against the security of the stored grain.

Profitability of storage is measured as the monthly, pre-tax, marginal return on equity (MROE) earned by a depositor (a trader or farmer) storing maize speculatively in a public warehouse, vis a vis the alternative of not storing, but buying and selling quickly on spot markets[5]. Deflated wholesale price series (converted to 1996 US$) are used in each case, 10 years for Ghana and 4 years for Zambia.

[5] It is emphasized that this definition takes no account of any incremental indirect costs associated with storage (e.g. management time, office expenses) or taxes on profits, and therefore overstates the profitability of storage. It is difficult to estimate costs of this kind, including the level of taxes which are actually paid.

MROE is calculated as $\frac{\text{Revenue - total incremental costs} \times 100\%}{\text{Equity invested}}$

where:

Revenue	=	S x (100-W)/100
Total incremental costs	=	TC x (100 + Int)/100
Equity invested	=	Equity portion of procurement and storage costs + interest
charges on		loan portion during storage
	=	E x TC + Int x TC x (100-E)/100
	=	TC x (E + Int x (100 - E)/100)

therefore, MROE = $\frac{S \times (100 - W)/100 - TC \times (100 + Int)/100}{TC \times (E + Int \times (100 - E)/100)} \times 100\%$

Symbols used are as follows:

S	=	sales price per tonne
W	=	weight loss percentage, due to handling, drying and storage
TC	=	incremental costs per tonne, including procurement, handling and storage (but excluding interest)
Int	=	interest to the date of sale (percent)
E	=	trader's equity as a percentage of the value of grain procured

Average MROE figures for the historical period concerned were then calculated, showing the month of initial purchase and month of sale. Sensitivity analysis was then applied see Table 1 .

TABLE 1: PROFITABILITY OF INTRA-SEASONAL STORAGE; ASSUMPTIONS USED

	Base case	Sensitivity
Monthly storage charges:		
Ghana	$3.50 per tonne month	$5.25 (+ 50%)
Zambia	$2.50 per tonne month	$3.75 (+ 50%)
Equity/total capital employed	25%	50% (+ 100%)
Interest charges	1% per month	1.5% (+ 50%)

Public warehouses' charges for storage and handling are estimated as those required to ensure the long-term viability of their operations, including the construction of new stores, based on the financial profiles for warehousing companies carried out in each country. Given a shortage of storage capacity, a relatively high charge was set for Ghana, $3.50 per tonne month vis a vis $2.50 per tonne month in Zambia.

TABLE 2: ESTIMATED MONTHLY MROE'S FOR STORING MAIZE USING INVENTORY CREDIT, IN GHANA AND ZAMBIA

Market	Month into store	Month out of store	Ranges of MROE, assuming: Base case	Storage charge + 50%	Interest charge + 50%	Equity percent + 100%	Worst case*
Techiman, Ghana	Sep/Oct Jan/Feb	Mar/June May/June	8 - 11% 10 -15%	6 - 8% 8 - 12%	7 - 10% 8 - 13%	5 - 7% 6 - 9%	3 - 5% 4 - 7%
Tamale, Ghana	Dec/Jan	May/July	7 - 8%	4 - 6%	5 - 7%	4 - 5%	2 - 3%
Kabwe, Zambia	Aug/Sep	Dec/Feb	15 - 19%	13 -17%	13 - 18%	10 - 12%	8 -10%

* i.e. assuming storage and interest charges + 50%, and equity percent + 100%

Monthly MROE's are very high in Techiman, Ghana, between 8 and 11% a month under the base case assumptions for storing between the major season harvest (September and October) and the lean season (March to June), equivalent to upwards of 100% on an annualised basis. Even higher returns may be obtained for storing for shorter periods.

Under the worst case scenario, an average MROE of 3% or more is obtained per month, i.e. upwards of 40% on an annualised basis.

In Tamale, it is assumed that the crop can only be stored in large quantities from December onwards, given the later harvest and lack of drying facilities. The MROEs are considerably lower than in Techiman (7 - 8% under the base case) and this suggests that the quickest way to stabilise prices may be to promote greater storage in south-central Ghana, rather than in the North of the country. Given the high spatial integration which characterises Ghana's maize market (Armah, 1989, Asante 1989), increased storage in the south-central Ghana can be expected to reduce seasonal price variability throughout the country and in neighbouring countries whose grain trade is closely connected[6].

Average MROEs are much higher in Zambia than Ghana; under the base assumptions they are 15 - 18% per month for storing over the most favourable 4 to 6 month period. However, as Zambian data only covers four years one must be cautious in drawing generalised conclusions from this comparison.

[6] Under ECOWAS rules, trade in maize is now duty-free.

7. THE ECONOMICS OF OPERATING WAREHOUSES

The field studies indicated that public warehousing for maize could most feasibly be developed through the following type of enterprises:

- In Zambia, a series of provincial warehousing companies typically operating two 5,000 tonne capacity storage sheds, under rental to the Food Reserve Agency. Such provincial companies could alternatively be linked together into larger national organisations. Financial analysis was carried out for a provincial company, under two turnover scenarios involving annual throughput of 10,500 tonnes and 30,000 tonnes respectively.
- In Ghana, a restructured and privatised version of the parastatal Ghana Food Distribution Corporation (GFDC). GFDC has the best physical facilities and acts as a public warehouseman, but cannot perform to the full of its capabilities under the present regime of public ownership. Financial analysis was applied to a restructured enterprise, operating 11 key sites, with quantities dried and stored rising from 30,000 tonnes and 15,000 tonnes respectively in the first year to 55,000 tonnes and 27,500 tonnes in the fifth year.

Based on the information assembled through the case studies, and comparison with costs elsewhere in the world, the next section makes four observations

a) African storage costs tend to be high by international standards.

In UK rates are typically around US$1.5 per tonne-month, in the US around $1.20, in Brazil $1.6, and in South Africa they are about $1.06[7]. By contrast the Zambian field studies indicated that to successfully run warehousing businesses in Zambia on a more substantial scale than at present, rates were likely to be upwards of $2.0 per tonne-month. In Ghana, the rate would need to be between $3 to $4 per tonne-month, and even this would not cover the replacement costs of GFDC's existing plant. The relatively low charges in Zambia reflect the abundance of storage capacity in that country.

Due to the adoption of conservative assumptions the estimates for Ghana and Zambia may be on the high side. Nevertheless, there are unquestionably cost factors making storage more expensive than in the more developed economies cited, i.e.:

- economies of scale in large-scale handling and storage. For example, a typical UK co-operative storage facility has a capacity of 40,000 tonnes, compared to an average of less than 2,000 tonnes for GFDC sites in central Ghana.

[7] These figures can only be taken as a rough indication of warehousemen's returns to storage. In some cases, storage is secondary to the main business of trading, and can be priced on the basis of marginal costs. In the United States, charges in early 1998 did not allow for the replacement of grain elevators. However, elevator companies make additional money by purchasing and marketing the stored produce, and can thus cross-subsidise storage.

- lower variability in production resulting in higher usage of available storage capacity. Most African countries are subject to wide weather-induced fluctuations in marketed grain output.
- local availability of plant and equipment, skilled building labour and maintenance services
- past subsidies or tax-breaks which have encouraged Western industry to invest in stores and equipment
- lower cost and greater accessibility of capital. With more efficient financial systems, debt is easier to access and its cost is much lower in nominal terms and more predictable. Equity capital is more widely available and generally requires lower remuneration.
- less theft and pilfering, so that security arrangements need be less rigorous. Ghana appears to be an exception in this regard, with many warehousing sites making do with a single night-watchman.

Storage facilities sometimes cost more to build in Africa, but this is not always the case - see Box 2. However, due to the small scale of operation, variable levels of throughput, high financing costs and other factors, it will often be more costly to operate stores in Africa.

b) Building warehouses is often unprofitable from a purely operational viewpoint

Much of the existing warehousing business in Africa is in areas around ports and is concerned with internationally traded commodities. Storage charges levied by companies in Mombasa and Greater Accra do not appear to justify investment in the warehouses concerned, bearing out the proposition that:

> *Some public warehousing companies exist and operate with the primary objective being to service the property debt through public warehousing while the facility appreciates in value for eventual sale to realise capital gain (Jenkins, 1990).*

In up-country locations of Africa, however, there is less prospect for property appreciation, and services may have to be priced at a level which guarantees a reasonable return on capital. On the other hand, the availability of surplus ex-parastatal warehouses often means that rentals are low and there is no need to build new stores. In Zambia, rentals for the large "CIDA sheds" are about $0.48 per sq m per month. Assuming that maize is stacked 2.5 tonnes per square metre, the cost is $0.192 per tonne-month capacity, or $2.30 per tonne-year.

An investor erecting a new storage structure would require a much higher rental rate in order to get an acceptable return. Let us assume warehouses cost about $80 per tonne capacity (see Box 2), have a useful life of 30 years, and that an investor needs a minimum return on capital employed (ROCE) of 10% per annum, exclusive of the appreciation in real estate. Then the

required annual revenue per tonne capacity is $8.49[8], i.e. 3.6 times the Zambian rental rate, to cover his capital costs alone.

BOX 2: THE COST OF STORAGE STRUCTURES

For economical use of space, warehouses should be built for storage up to a height of at least 4 metres, allowing stacking to a density of 2.5 tonnes per square metre. Warehouse operators may manage capacities of up to 3.5 tonnes per square metre under exceptional circumstances, but 2.5 tonnes is a more realistic figure for normal operation.

When all costs including land, access roads, perimeter fences, office space and engineering services are taken into account, it is difficult to get such warehouses built on a turn-key basis, in most countries, for much less than $200 per sq m. Warehouses can be built more cheaply by direct labour, but in this case the true costs are likely to be hidden in the overheads of the company concerned. In some urban areas, e.g. Mombasa and Nairobi, costs can range up to $340 per sq m, due to high cost of land. In some countries, the ravages of war and economic adjustment have left a legacy of weak building services; e.g. up-country areas of northern Mozambique, prices up to $350 per sq m were quoted. Cheaper storage facilities are erected in and around South Africa, for as little as $150 per sq m, using pre-fabricated structures with metal cladding. While the latter provides little resistance in the event of accidents like falling stacks, emerging private traders often prefer it on grounds of economy.

Bearing in mind the above consideration, we take $200 per tonne capacity as a rule of thumb for building warehouses in most parts of rural Africa, assuming the local building industry is reasonably efficient. At 2.5 tonnes per square metre, the cost per tonne of storage capacity is around $80.

The alternative to bag warehouses is bulk storage, either using metal silos or flat stores with mechanical loading in and out. Large flat stores are generally cheaper than silos, but due to poor security and other disadvantages, are unlikely to be widely used in most African countries. The cost of metal silos facilities vary widely according to scale, foundations, quality standards, sophistication, the need for mechanical dryers and installation costs. A rough rule of thumb for Africa is $125 per tonne, i.e. over 50% more than for bag stores. However, small sites with capacity of 1,000 to 2,000 tonnes, with grain drying and cleaning at 8 tonne per hour may cost over $200 per tonne. Large state-of-the art stores in the UK cost $165 - $200 per tonne to build, but less sophisticated facilities for 1,500 tonnes, suitable for on-farm use, can be built of $135 per tonne (Grant Thornton, 1997).

[8] Calculated thus: annuity factor = 9.427, annual cost per tonne capacity = $80 / 9.427 = $8.49

c) The cost of building or leasing warehouses is sensitive to capacity utilisation, which tends to be low in Africa

Fixed warehouse costs can be reduced by leasing, but as noted above, costs can be high due to weather-induced variations in throughput from year to year, and consequently, low capacity utilisation. Many African countries (e.g. Zambia, Zimbabwe and South Africa) are subject to very high inter-annual production variability, and this increases the cost of storage capacity, vis a vis the situation in North America and Europe. Zimbabwe's Grain Marketing Board (GMB) has a low cost solution to this problem, by building open-air stacks on poles or plinths. With this system, capital costs may be as little as US$12 per tonne stored (NRI estimates based on data from GMB).

d) It is difficult to establish warehousing services on their own, and there is usually an overwhelming case for linking them to other business activities

Due to low levels of profitability, public warehousing companies do not appear in profusion in up-country areas of African countries. They must survive on fixed charges for in/out handling, storage, pest control, and (sometimes) drying and cleaning, and face significant risks of: (a) not being able to generate the sufficient volume of business to cover fixed costs, and; (b) theft and embezzlement. *At the same time they must compete with their own customers*, i.e. traders, millers etc. who may alternatively store the produce themselves, while making more efficient use of their fixed staff complement, which can be employed in both storage and trading activities. By contrast, when there is little storage activity, the staff of a public warehousing company is likely to be largely idle.

Table 3, taken from the Zambian field-study, illustrates the low profitability of the "stand-alone" warehousing business. The company concerned has capacity for 10,000 tonnes of maize, and under scenario (a) - throughput of 10,500 tonnes - achieves 70% occupancy for 6 months. ROCE is 0% and return on equity (ROE) is -25%.

TABLE 3: PROFITABILITY OF PUBLIC WAREHOUSING UNDER ALTERNATIVE SCENARIOS

	Scenario (a)	Scenario (b)
Occupancy	70% for 6 months	70% for 6 months (high season); 30% for 6 months (low season)
Turnover of stock:		
- times per season	1.5 times in high season only	3 times in high season; 3 times in low season
- tonnes per annum	10,500 tonnes	30,000 tonnes
Charges:		
- in/out per tonne	$5	$5
- storage/tonne-month	$2.50	$2.50
Capital employed	$ 98,182	$120,824
Annual revenue	$136,500	$270,000
ROCE	0%	70%
ROE (1)	- 25%	81%

Note: (1) Equity = 50% of cap. Employed. **Source:** Coulter *et al.* (1996), page 20, Table 5.

Companies providing warehousing services often combine warehousing services with other activities, and this allows them to spread their overheads over a larger volume of business. Under Scenario (b), the company in Table 3 has another business activity (e.g. trading or brokerage) that allows it to nearly triple stock turnover, and thereby to derive extra income from fees earned from handling the grain in and out of store. The ROCE jumps to 70% and ROE to 83%.

8. CONCLUSIONS: THE WAY FORWARD IN AFRICA

Markets appear to have been performing poorly in terms of intra-seasonal arbitrage in the two countries studied, so that experienced grain traders leveraged by collateralised bank credit have been able to make very large profits through the speculative storage of maize, albeit with significant speculative risk. In the case of Zambia it should be noted that the country has only enjoyed four years of truly liberalised marketing, and if the same policies were pursued consistently returns might fall to more normal levels. In Ghana, relatively few traders have been storing intra-seasonally and much of the speculative gain has been accruing to those farmers able and willing to store.

The analysis of warehousing economics shows that warehousing companies operating in the grains business in producing areas of Africa must combine storage with other business activities. The following approaches may be considered:

a) **Being traders in their own right.** This is the most obvious solution, and one that has been practised in Zambia. The approach has been most highly developed with the "Elevator Company" model of the

United States, where there is a thoroughgoing system of legislation and public oversight[9]. Such a system was recently recommended for adoption in Brazil, where public warehousing companies are prohibited from trading by law (Leão da Sousa and Marques, 1997).

A difficulty with this approach is that grain storage is sometimes so profitable in Africa that traders are unwilling to store for others. At the same time, their customers may see a conflict of interest between their trading interests and their warehousing functions and be reluctant to use their services. This happened in Ghana when the parastatal GFDC went into the storage business. Such problems are difficult to handle in countries where warehousing companies are subject to no system of public scrutiny.

b) **By acting by collateral managers for the banks.** Sometimes, warehouse operators can increase their revenue simply by becoming *collateral managers,* acting as custodian on behalf of a lender. This explains why international inspection companies, which often enjoy considerable confidence with local and international banks, have become increasingly active in this field. In coastal Ghana, such a company can charge up to three times for storage as much as can competitors offering no collateral management service. By raising standards of performance and obtaining suitable insurance cover, African-owned warehousing companies may get more of this business.

Collateral management services may be particularly attractive with banks which have a heavy agricultural lending portfolio - hence the Banco do Brasil is seeking to create a network of regulated warehouses through which it can channel funds and organise brokerage services (Coulter *et al.*, 1998).

c) **Combining warehousing with freight-forwarding .** In study in northern Mozambique (Coulter and Sondhi, 1996), it was proposed that a freight-forwarder establish warehouses along the line of rail between Malawi and the port of Nacala. In addition to storage income, the company would develop its forwarding turnover in a rich agricultural zone. It would also help the company make fuller use of its largely unutilised storage facilities in the port of Nacala.

d) **Linking warehouses to a brokerage operation**. The warehouse company employs a broker, whose job it is to sell depositors' produce in return for a fixed commission. This is conceptually similar to grain marketing co-operatives in the UK and elsewhere. Depositors are attracted because they can store, obtain a loan or advance payment, and be assured a market for their produce. The same approach is being employed in Brazil where - the Banco do Brasil provides

[9] An elevator company will not only store for farmers, but will purchase their grain under a variety of contractual arrangements to farmers (including spot, forward, delayed pricing and others), and extend finance for inputs. They are in close proximity to farmers, and are therefore well placed to vet loan applicants and minimise default.

brokerage services to farmers through regulated warehouses.

e) **By linking a series of warehouses to a commodity exchange.** As in the brokerage case, the depositor uses the warehouse not just to store and obtain financing, but to find a market for his/her produce. This increases the warehouse's turnover-related income, and also benefits the commodity exchange, because the warehouse receipts can be used to document delivery against contracts. A problem in the establishment in new exchanges in Africa is finding ways of guaranteeing the performance of sellers. One way of overcoming this is by requiring sellers to deposit stock in a licensed warehouse before offering it for sale through the exchange (see Coulter *et al.*, 1996, pages 38-56 for discussion of a Zambian example).

While warehousing has an important role to play, parallel improvements are needed in other areas in order to reduce seasonal price variability. Above all, it is important to improve the process by which players decide whether and when to buy, store and sell grains. Critical to this is the availability of accurate production forecasts and estimates, and transparent and consistently enforced rules governing the international trading relationships. The absence of these elements makes storage decisions more risky while raising the returns to those who are able to take the risk.

REFERENCES

Anon (1996) Collateralised Commodity Financing, with Special Reference to the Use of Warehouse Receipts. Report by the UNCTAD Secretariat. UNCTAD/COM/84. 49 pp.

Armah, P.L. (1989) *Post-harvest Maize Marketing Efficiency: the Ghanaian Experience.* PhD Thesis, Department of Economics and Agricultural Economics, University College of Wales, Aberystwyth. 353 pp.

Asante, E.O., ASUMING-BREMPONG, S. and BRUCE, P.A. (1989) *Ghana; Grain Marketing Study.* Consultancy report prepared for IFDC-Africa and the Ministry of Food and Agriculture.

Coulter, J.P. and Shepherd, A.W. (1995) *Inventory Credit; an Approach to Developing Agricultural Markets.* FAO Agricultural Services Bulletin 120. 107 pp.

Coulter, J.P. and Sondhi, J. (1996) *Warehousing and Inventory Credit in Northern Mozambique; Project Formulation Mission.* NRI Consultancy Report to the Nerthlands Ministry for Development Co-operation, No. R2340C

Coulter, J., Sondhi, J., Kotecha, P. and Boxall, R. (1996) *The Economics of Warehousing in Zambia and its Role in Agricultural Development.* NRI research report R2323(S).

Coulter, J.P., Leão de Sousa, E., and Martines, J. (1998) *Brazilian Experience with Grain Warehousing Services and Associated Marketing Tools.* Report commissioned by the DFID Crop-Post Harvest Programme.

Grant Thornton (1997) *Grain Storage Cost.* Paper produced for the Royal Show by Grant Thornton Accountants in Agriculture, and the Royal Agricultural Society of England.

Jenkins, C.H. (1990) *Complete Guide to Modern Warehousing Management.* New York: Prentice Hall.

Lacroix, R. and Varangis, P. (1996) Using warehouse receipts in developing and transition economies, in: *Finance and Development,* September 1996, 33(3), 36-39.

Leão da Sousa, E. and Marques, P. (1997) Competitividade do milho e soja nos Estados Unidos e Brasil, in: *Preços Agrícolas,* November 1997.

FIGURE 1: WHOLESALE MAIZE PRICES IN TECHIMAN, GHANA, 1986/87 IN CONSTANT DEC. 1996 US$ PER TONNE,

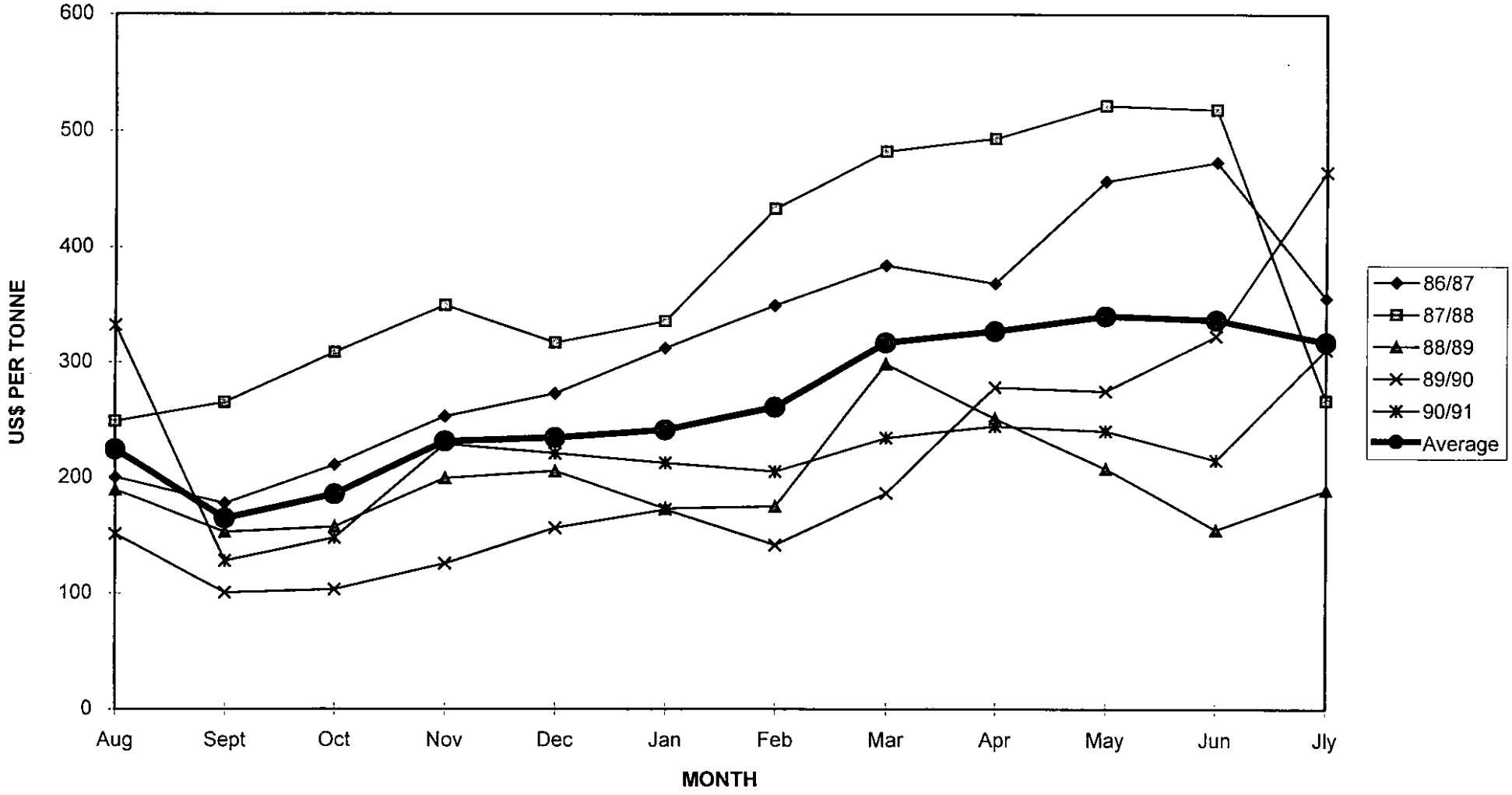

FIGURE 2: WHOLESALE MAIZE PRICES IN TECHIMAN, GHANA, 1991/92 TO 1996/97 IN CONSTANT 1996 US$ PER TONNE

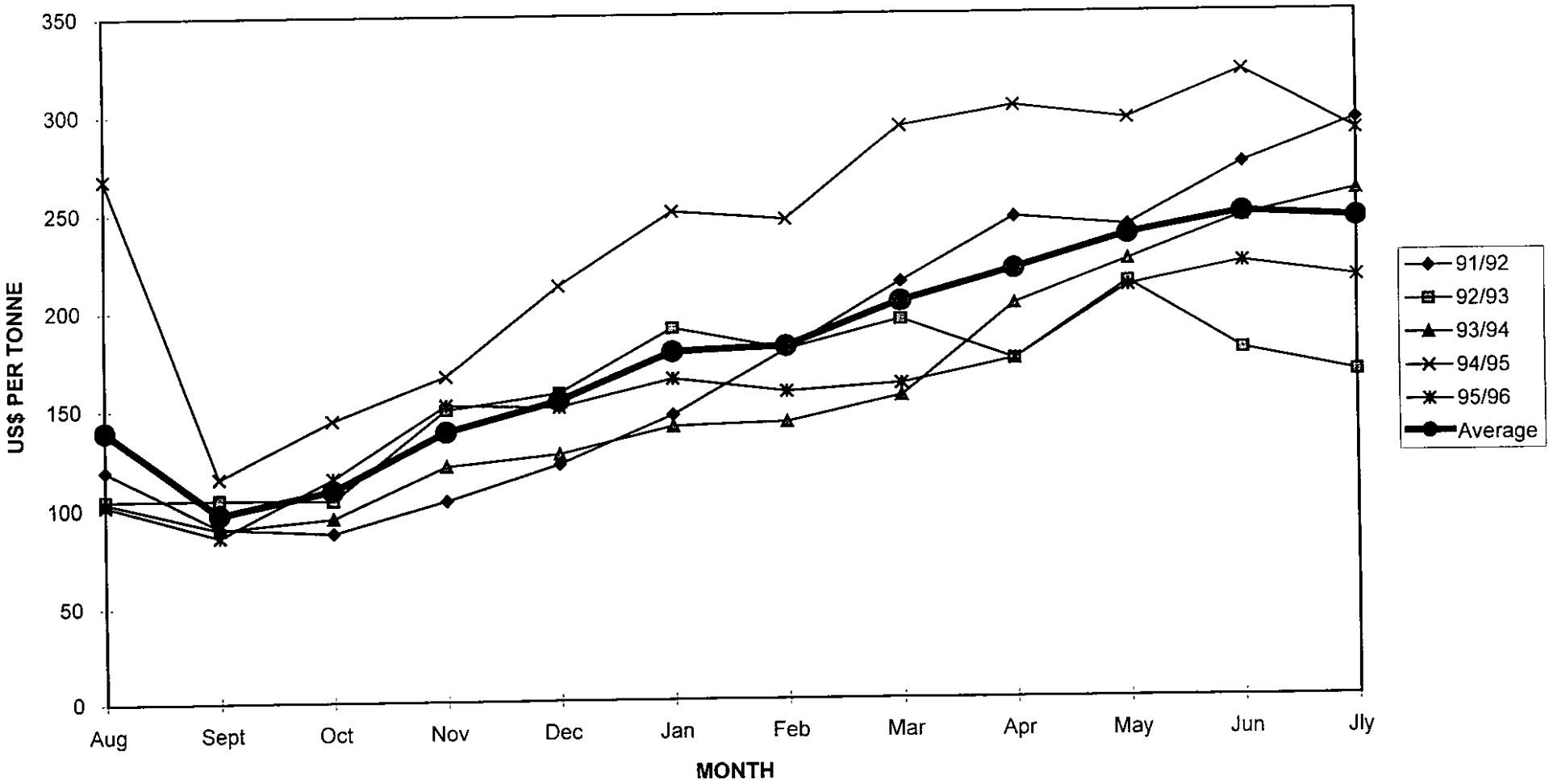

FIGURE 3: WHOLESALE MAIZE PRICES IN KABWE, ZAMBIA, 1994/95 - 1997/98, IN CONSTANT DEC. 1996 US$ PER TONNE