AGRICULTURAL RESTRUCTURING IN SOUTHERN AFRICA

Papers presented at an International Symposium held at Swakopmund, Namibia 24-27 July, 1990

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PRIVATE AND SOCIAL CONSIDERATIONS IN THE DESIGN AND APPRAISAL OF DEVELOPMENT PROJECTS AND RELATED AGRICULTURAL POLICIES: THE CASE OF WHEAT IN ZAMBIA

M M Snodgrass

INTRODUCTION

Background statement

National planning for economic development has become an institutionalized process in most lesser developed nations of the world. A national plan is comprised of a set of development projects which individually and collectively are designed to contribute to achieving certain economic and social goals for the nation. Ideally, governments should have a complementary set of price and trade policies that would enhance the success rate of development projects.

It is now common practice to design and appraise development projects through a rigorous process including (at a minimum) technical, financial, social, economic, and environmental analyses. Price and trade policies are usually taken as given when appraising development projects. These policies directly affect net financial profitability (NFP) for farmers as development project participants. For example, policies that result in subsidized input prices and/or output prices above import parity enhance private participant net financial profitability, but do not affect the net social profitability (NSP) of the project. Policies relating to exchange rates do affect NSP. Both private and social considerations must be carefully assessed at the project design and appraisal stages since exchange rates, import parity prices, and government-administered prices are subject to change.

The Zambian economy

The economic goals of Zambia's national development plan are similar to many other developing nations'. Problems of scarce foreign exchange, an overvalued currency, a neglected agricultural sector, rural-urban migration, unemployment, and heavy drains on the government budget existing from years of consumer subsidies work against social and economic development. In recent years, Zambian policy-makers have demonstrated a willingness to implement economic reforms to stimulate growth and to meet the conditions of donor and lending agencies for continuing loans and grants.

In 1975, the Government of Zambia (GOZ) undertook a concerted wheat production initiative because of the high cost of wheat imports and the strain which these imports placed on the country's transport routes (Dodge, 1977:144). Soon thereafter, the GOZ began receiving technical assistance from the Canadian International Development Agency (CIDA). New high-yielding varieties that produce well under both irrigated and rain-fed conditions have received attention.

Problem statement and hypothesis

The financial profitability of wheat production depends on the guaranteed price paid by the government relative to the farmers' costs of production. In Zambia, inputs requiring
foreign exchange comprise about 70% of total wheat production costs. The price of fertilizer is subsidized 40-80% depending on type. The NSP of substituting domestic wheat for imported wheat is dependent on the import parity price (IPP), the percentage of total costs represented by imported inputs, domestic input costs, and the shadow exchange rate. Foreign exchange is a critical component in project appraisals because of its dual role in the calculation of both benefits and costs. For the period October 1985 to March 1987, foreign exchange auctioning resulted in a wide range of exchange rates; none of which probably approximated the shadow exchange rate. Given the high foreign exchange cost, the widely fluctuating exchange rate, and a producer price for wheat not based on the import parity prices, the following hypothesis was postulated: an import substitution strategy implemented by wheat "project" and "policy" initiatives may enhance the NSP to society but yield a negative NFP to wheat farmers depending on the exchange rate, the IPP, and the government-administered price. Objectives of this study are (1) to evaluate Zambian import substitution strategy for wheat, (2) to illustrate how the exchange rate and import parity price interact and affect the level of NFP and NSP, (3) to illustrate how other variables such as wheat yields and the ratio of foreign exchange input costs to domestic costs affect NFP and NSP, and (4) to illustrate how Zambian agricultural policies for wheat might be utilized in development project designs and appraisals.

**METHODOLOGY AND DATA**

To evaluate the Zambian import substitution strategy, NFP for wheat producers was compared to NSP for 1986 and 1987. Second, NFP and NSP were compared at a range of exchange rates. Third, sensitivity analysis was used to study the effect of key variables. This methodology uses NFP and NSP as indicators of project and/or policy acceptability. The analysis uses Ministry of Agriculture and Water Development (MAWD) cost and return budgets for irrigated wheat in 1986 and 1987 and for dryland wheat for 1986. The budgets prepared by the Commercial Farmers Union were generally the basis for government-guaranteed price decisions until the late 1980s when MAWD personnel developed their own set of information.

**Net Financial Profitability (NFP)**

NFP per ton of wheat equals the government-guaranteed price less fixed and variable costs of production. Local currency costs for imported inputs were based on an exchange rate of eight kwacha to the dollar for 1986 and nine kwacha to the dollar for 1987. The budgets estimate the percentage of foreign exchange required for each input, the input quantities used by the average wheat farmer, and the financial prices paid for inputs. Wheat yields were assumed to be 4.86 tons per hectare for irrigated wheat and 1.8 tons per hectare for rain-fed wheat. Total production costs per ton were separated into domestic costs and foreign exchange costs.

**Net Social Profitability (NSP)**

To calculate NSP per ton of wheat, the dollar cost of imported inputs is first subtracted from the border price or the IPP. This result is then multiplied by a shadow exchange rate (SER) yielding a sum from which the domestic costs of production are subtracted. Choosing the SER was a judgment made on the basis of the official exchange rate (OER) that resulted from a weekly auctioning of foreign exchange in Zambia from October 1985 through March...
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1987 plus the observed behavior of the black market. After considering these factors, a SER of 15:1 was used for 1986 and 25:1 for 1987.

The estimation of NSP requires several adjustments to the financial cost and return budgets. First, all transfer payments such as taxes and interest were removed and taxes were not treated in the budgets. Regarding interest cost, the MAWD considered it to be 70% foreign exchange cost and 30% domestic cost. The elimination of domestic interest cost resulted in the 1986 rain-fed wheat cost of production to be lowered by K176.32 per hectare, the 1986 irrigated wheat cost by K375.01 per hectare, and the 1987 irrigated wheat cost budget by K575.37 per hectare.

Financial prices were adjusted where subsidies exist and where prices do not reflect opportunity costs. Fertilizer was the only input receiving a subsidy. Fertilizer costs for 1986 were adjusted upwards by 41% for D-mixture and 76% for urea fertilizer to reflect the higher social cost. For 1987, the percentage subsidies used for the two types of fertilizer were 41% and 79% respectively. All other inputs were judged to reflect their opportunity cost.

It was necessary to use the IPP to value social returns for the calculation of benefits. The relevant IPP price used was based on prices at the principal wheat processing plant in Kabwe. After consideration from several sources, it was decided to use an IPP of $210 for 1986 and $205 for 1987.

**RESULTS**

Using the 1986 and 1987 budgets, both NFP and NSP were positive for irrigated wheat in 1986 but NFP was negative in 1987. Rain-fed wheat showed NFP negative in 1986 while NSP was positive (Table 1).

<table>
<thead>
<tr>
<th>Item</th>
<th>1986</th>
<th>1987</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigated</td>
<td>NFP</td>
<td>NSP</td>
</tr>
<tr>
<td></td>
<td>(kwacha per ton)</td>
<td></td>
</tr>
<tr>
<td>NFP</td>
<td>261.45</td>
<td>1046.55</td>
</tr>
<tr>
<td>NSP</td>
<td>111.39</td>
<td>516.86</td>
</tr>
</tbody>
</table>

Assuming that the government-administered price paid was equal to the import parity price and that the official exchange rate reflected the true value of the kwacha, results would be:

<table>
<thead>
<tr>
<th>Item</th>
<th>1986</th>
<th>1987</th>
</tr>
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<tbody>
<tr>
<td>Irrigated</td>
<td>NFP</td>
<td>NSP</td>
</tr>
<tr>
<td></td>
<td>(kwacha per ton)</td>
<td></td>
</tr>
<tr>
<td>NFP</td>
<td>1155.52</td>
<td>1046.55</td>
</tr>
<tr>
<td>NSP</td>
<td>752.13</td>
<td>516.86</td>
</tr>
</tbody>
</table>

The government-guaranteed price per ton for wheat was K1 500 in 1986 and K1 833 in 1987. Production costs rose faster than the government-guaranteed price from 1986 to 1987, resulting in financial losses. These cost increases coupled with a decrease of $5.00 in...
the import parity price reduced NSP by 49% between 1986 and 1987. Rain-fed wheat in 1986 was socially profitable but not financially profitable. If farmers had received the import parity price in both years, their financial profitability would have been 69% higher in 1986 (K441.47 instead of K261.45 per ton) for irrigated wheat and, instead of a loss of K89.32 for rain-fed wheat, they would have had a profit of K90.68 per ton. In 1987, receiving the import parity price would have reduced financial losses slightly from K111.39 to K99.71. Furthermore, if farmers had received the IPP, AND IF the OER would have reflected the true value of the kwacha (estimated to be 25:1), NFP for irrigated wheat would have been 342% higher in 1986 and the loss of K111 in 1987 would have been a gain of K752.

**NFP and NSP at various exchange rates and import parity prices**

When the government-guaranteed price paid to farmers is equal to the import parity price, the difference between NFP and NSP is a fixed amount. The difference depends on (1) how much total cost changes when transfer payments (domestic interest costs) are eliminated, (2) amount of subsidies on inputs, and (3) the level of the exchange rate assumed. For each $10 increase in the IPP, the NSP and NFP increase by a factor of ten times the exchange rate. As the exchange rate increases, the difference between NSP and NFP increases. For example, at 7:1, NFP exceeds NSP for irrigated wheat (1986) by 19 kwacha at all levels of IPP but at an exchange rate of 15:1, NFP exceeds NSP by 109 kwacha.

To summarize the Zambian wheat situations, NSP for irrigated wheat was lower than NFP at exchange rates of 6:1 and above in 1986 and 8:1 and above in 1987. For 1986, at exchange rates of 11-15:1, both NFP and NSP were positive at IPP’s of $150 and higher. However, a year later (1987), both were not positive until the IPP reached $190 and the exchange rate was 20:1. If the rate of 15:1 used to reflect the SER in 1986 was a valid estimate and the IPP was $210, then NFP and NSP would be K1 156 and K1 047 respectively for irrigated wheat, indicating that the import substitution strategy for wheat was acceptable. For 1987, using an SER of 25:1 and an IPP of $205, NFP and NSP would be K1 130 and K517 respectively per ton reflecting similar support for substituting domestic production for imports.

The results for rain-fed wheat would also support an import-substitution initiative. At a 15:1 rate, using an IPP of $210, NFP would be K593 while NSP would be K394.

**Sensitivity analysis**

A sensitivity analysis was performed to identify the relative importance of variables impacting NSP and NFP. The following variables were considered: import parity price, input costs requiring foreign exchange, domestic input costs, shadow exchange rate applied, percentage of total costs represented by imported inputs, and wheat yields per hectare. The largest impacts on NSP were from the IPP, wheat yields, and the cost of imported inputs. Wheat yields, the cost of imported inputs, and the government price had the greatest impact on NFP (Table 2).

Changes in the assumptions for IPP, SER, and percentage of total costs from imported inputs have no effect on NFP. An increase of one percent in the government-guaranteed price in 1987 would have reduced NFP losses by 16.47% for irrigated wheat and 16.79% for rain-fed wheat. Increases in imported input costs (based on 1987 budgets) would have resulted in further losses of over 12% for irrigated wheat in 1987 and rain-fed wheat in
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1986.

The sensitivity analysis results are instructive only to suggest the relative impact of some variables hypothesized to be important. The percentage results are only valid for a change at the margin of one of the variables and quantitative aggregation of the results would have little or no value.

Table 2

Sensitivity analysis results for impacts on Net Social Profitability and Net Financial Profitability from selected variables, irrigated and rain-fed wheat, Zambia 1986-1987

<table>
<thead>
<tr>
<th>Variable</th>
<th>Net Social Profitability</th>
<th>Net Financial Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Irrigated</td>
<td>Rain-fed</td>
</tr>
<tr>
<td>Import parity price</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government price to producers</td>
<td>No effect</td>
<td>No effect</td>
</tr>
<tr>
<td>Imported input costs</td>
<td>-1.71</td>
<td>-9.01</td>
</tr>
<tr>
<td>Domestic input costs</td>
<td>-0.30</td>
<td>-1.00</td>
</tr>
<tr>
<td>% of total cost from imported inputs</td>
<td>-1.06</td>
<td>-6.77</td>
</tr>
<tr>
<td>Wheat yield</td>
<td>1.98</td>
<td>8.79</td>
</tr>
<tr>
<td>Shadow exchange rate**</td>
<td>1.30</td>
<td>1.91</td>
</tr>
</tbody>
</table>

* Net financial profitability were losses. Thus positive percentages represent reduction in losses and negative percentages represent further increases in losses.


Discussion of results

The hypothesis postulated was clearly supported by the results. It is important that project designers and policy-makers have an understanding of the situations where NSP and NFP may be significantly different. A project or policy initiative can be "incompatible" from a private vs. social view. Governments can control the prices they pay to farmers. Governments cannot control import parity prices. Governments can control official exchange rates but cannot directly control the real value of their currency and thus SERs. Governments can subsidize inputs (either domestic or imported) to reduce farmers' costs and thus increase NFP, but governments cannot control the foreign exchange cost of imported inputs. Given what governments can and cannot control, the following generalizations that have direct implications for project designers and government policy-makers may be concluded from studying the Zambian wheat case.

- When farmers receive the IPP either through market mechanisms or as a government-guaranteed price, differences between NFP and NSP are very small. But when farmers do not receive the IPP price, large differences between NSP and NFP can occur. In the Zambian case, if irrigated wheat farmers had received the IPP in 1986, and if the OER would have reflected the true economic value of the kwacha (assumed SER was 15:1), then NFP would have been K1 156 per ton instead of K262 - K109 higher than NSP. For rain-fed wheat in 1986, NFP would have been K593 (K76 higher than an NSP of K517)
instead of a negative K89. In 1982, the GOZ adopted the principle of "economic pricing" and agreed with the World Bank to take into account border prices when setting producer prices (Gulhati, 1989:44).

- Production-oriented projects or agricultural policies designed to increase domestic production as an import-substitution strategy are much more desirable if the increased production can be achieved with a high percentage of domestic inputs. In the Zambian wheat case, approximately 75% of the total social costs of production for both irrigated and rain-fed wheat were from traded inputs requiring foreign exchange and only 25% from costs of domestic inputs. If this 75/25 ratio were 25/75 instead, NSP would have been increased by 54% for irrigated wheat in 1986, 344% for irrigated wheat in 1987, and 184% for rain-fed wheat in 1986.

- The ratio of foreign exchange costs to domestic costs has no effect on NFP. Given any level of total cost of production, farmer profitability is not influenced by the ratio but only by the magnitude. It is also important to notice that only the OER influences NFP and not the SER.

- When financial cost budgets are adjusted for social accounting, the elimination of domestic interest costs reduces total cost while adjustments for any input subsidies raise total cost. To the extent that these offsetting affects are equal, private and social costs of production are not significantly changed. If producers are able to receive the import parity price and the currency is not overvalued, both NFP and NSP would be equal at any assumed exchange rate. Due (1986:28) emphasizes that realignment of overvalued exchange policies should stimulate initiatives in private production of formerly imported commodities if economies are liberalized to favor the private sector.

- While the analysis presented does not include the investment costs incurred by CIDA and the Government of Zambia in improving per hectare wheat yields, the sensitivity analysis results (Table 2) suggest that this investment is worthwhile. The investment could also be considered critical to a wheat initiative as an element in a larger development project.

- The probability of a successful import substitution strategy is greatly increased in situations where a country is landlocked and has no ocean port of entry. In the Zambian example, the import parity price is nearly doubled due to port handling and transport costs. A country such as Zambia can have an absolute disadvantage in costs of production relative to other producers and still achieve a relatively high NFP and NSP by substituting domestic production for imports.

**IMPLICATIONS FOR AGRICULTURAL POLICY-MAKERS, PROJECT DESIGNERS AND PROJECT APPRAISERS**

The Zambian wheat case clearly sends signals that agricultural policies are important in determining the private and social acceptability of initiatives to substitute domestic production for imports. Project designers developing a logframe matrix for such a project could include in the assumption column on the project purpose row that "the government-guaranteed prices paid are equal to the IPP" or that "the local currency is devalued to approximate its true value". This might precipitate some useful discussions regarding the relationships between the development project and existing agricultural policies. While preparing an analysis for a particular project cannot answer questions relating to the impact of changing an existing government price or trade policy (something that is nearly always needed and welcomed), the financial and economic analysis performed by project designers
and appraisers could very well result in some useful signals to policy-makers as they contemplate a new policy or the changing of an existing one.

The Zambian wheat case suggests that project designers and project appraisers should be very concerned about looking at both private and social profitability when the project is in a country where any of the following conditions exist: landlocked country, overvalued local currency, government-guaranteed price different from the import parity price, and imported inputs comprising a relatively high percentage of the total costs of production. Any combination of these conditions should be of special concern to project designers and appraisers.

The Zambian case suggests that in situations where an import substitution strategy is being followed, the commodity initiative should be viewed as a "project" which includes early investments to improve physical productivity levels. This was the case in Zambia with the help of CIDA. Irrigated wheat yields were raised from approximately one ton per hectare before the CIDA "wheat project" (began in late 1970s) to 4.86 tons per hectare by 1986-1987. The impact of physical yields on both NSP and NFP have been shown to be substantial. One reason this increase was achieved in a relatively short period of time was because irrigated wheat in Zambia is grown on larger commercial farms and a few large state farms. The progress would have likely taken longer if the project had been targeted to a large number of small subsistence type farmers.

REFERENCES