OPPORTUNITIES FOR ENHANCING PERFORMANCE
IN RWANDA'S
ALCOHOLIC BEVERAGE SUBSECTOR

by
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with the assistance of
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August 1987
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LIST OF ACRONYMS

BRALIRWA - Brasseries et Limonaderies du Rwanda
BRD - Banque Rwandaise de Developpement
ENBC - Enquete Nationale Budget Consommation
FRw - francs rwandais
GRET - Groupe de Recherche sur les Techniques Rurales
MINAGRI - Ministere de l'Agriculture
MINIFINECO - Ministere des Finances et de l'Economie
MINIMART - Ministere de l'Industrie des Mines et de l'Artisanat
OVIBAR - Office de Valorisation Industrielle de la Banane au Rwanda
PRIME - Policy Reform Initiatives in Manufacturing and Employment
SESA - Service des Enquetes et Statistiques Agricoles
USAID - United States Agency for International Development
PREFACE

Rwanda's Ministry of Finance and Economy has commissioned this review as the third in a series of subsector studies aimed at improving policy makers' understanding of the functioning of key segments of Rwanda's nonfarm economy. Funded through USAID's project PRIME, these studies focus particularly on the impact of government policies on employment, equity and efficiency in each subsector under review. The reviews aim to identify opportunities for improving economic performance through both technical and policy intervention. In so doing, they serve as an input in ongoing policy reviews - of the investment code, tariff structure, interest rates and banking policy, taxation and public expenditure policy. Likewise, the subsector studies complement ongoing subject specific reviews of each policy area by examining the impact of the policy environment on a sequence of economically important subsectors of the economy.

In undertaking this study, numerous individuals and organizations have furnished valuable support. Of central importance is the Ministry of Plan whose National Budget and Consumption Survey (ENBC) provides an unusually detailed and comprehensive review of rural economic transactions - production and consumption - over an entire year. Given the normal difficulties in accurately estimating aggregate home brewer activity, this information source affords, for the first time, the unusual opportunity of estimating national home brewing aggregates. It likewise provides the detailed micro-economic data necessary for assessing characteristics of producers and consumers and for computing key parameters - price and income elasticities - of importance to decision makers aiming to evaluate the impact of their policies on the subsector. Nicholas Minot of the Ministry of Plan provided invaluable input to the present review, performing the bulk of the National Budget Consumption Study (ENBC) data analysis. His colleague at MINIPLAN, Bonaventure Niyibizi, assisted in these efforts, and together they furnished a quantitative profile which improved immeasurably the level and quality of analysis available during this review.

In a different way, Gregory Kruse of Technoserve provided valuable support. He participated in much of the field work, asked important questions, and made sensible suggestions and observations throughout the study. He and Jim Herne, Director of Technoserve, volunteered valuable information and contacts available through Technoserve's operational network.

Messrs. Jean Marie Vianney Mbaguta, Donald Mead, Augustin Ngirabatware, and Nguyen Huu Khiem of the Ministry of Finance and Economy (MINIFINECO) and Project PRIME provided analytical and logistic support throughout the study. Professor Mead, in particular, assisted with the design and analytics of the review. USAID provided valuable assistance through their support staff and the offices of Micheline Mescher, Rosemarie Depp, Michael Fusch-Carsh, Ed Robbins and Tharcisse Kubimana. Many others also lent support at various stages. Especially helpful were Immanuel Munyangendo of OVIBAR, Leonard Ngirumwami, Yvan deJaegher, Jean Marie Sehene, and Theobald Kampayana of the Service des Enquetes et Statistiques Agricoles (SESA), Christa Desert of the Agricultural Research Station at Rubona, Patrick
Nugawela and Charles Nyamwigendaho of the Ministry of Mines, Industry and Artisanat (MINIMART), Pierre Cauvin and Athanase Karekezi of MINIFINECO, Francois Mugemana of the Ministry of Agriculture (MINAGRI), Joanne Csete of Cornell University, Albert Mudende, shortly to begin work at the Rwandan Development Bank (BRD), Marc Denys of Project Kibungo II, Dr. Andre Muhire of Food Technology and Plants, Thadsee Gatarasi and Mr. van Boeimeer of BRALIRWA. In addition, numerous home brewers, cabaret owners and transporters took time from their enterprises to describe the production and distribution system through which sorghum and bananas are transformed
I. INTRODUCTION

Home-brewed banana wine and sorghum beer dominate Rwanda's alcoholic beverage market, although western formula "clear" beer has made substantial inroads over the past 25 years. Imported hard liquor and wine as well as industrially brewed banana wine play only minor supporting roles.

As a group, these beverages command considerable attention, on both social and economic grounds. Banana wine, and to a lesser extent sorghum beer, play a central role in social relationships. Weddings, birth celebrations and festivals of all sorts are unthinkable without copious quantities of banana wine. Reciprocal exchanges of banana wine cement social relationships and serve as payment for communal work parties.

Economic muscle reinforces the importance of alcoholic beverages, especially in the minds of policy makers. The home-brewed beverages, banana wine and sorghum beer, account for over 50% of all manufacturing value added in Rwanda (Ministry of Plan, 1986a). The market for these drinks is huge, generating fully 35% of rural cash income[1] (Ministry of Plan, 1986b). Because over 80% of all rural households produce banana wine or sorghum beer (see Table 10) and because virtually all production takes place in rural areas, policy goals of equity and geographic dispersion of manufacturing activity magnify the importance of these beverages. A recent review estimates that these home-brewed beverages support about 60% of total manufacturing employment when employment is calculated in full-time equivalents (Khiem, 1987).

Together with domestically produced industrial "clear" beer, these beverages generate 9% of GDP (Ministry of Plan, 1986a). Moreover, the clear beer alone furnishes fully 20% of central government revenues through a special consumption tax collected at the brewery.

In addition to their favorable contributions, alcoholic beverages exhibit several serious economic liabilities which reinforce policy makers' interest in them. First, the raw materials necessary for home-brewed beverages - beer bananas and sorghum - occupy 28% of cultivated land area, 14% each[2] (Ministry of Agriculture, 1985). Although sorghum is primarily a second season crop, bananas are perennials and hence occupy land that could be double cropped if removed from banana production. The opportunity cost of beer banana and sorghum production is considerable in Rwanda, the most densely populated country in Sub-Saharan Africa, where most observers agree that land scarcity will be the primary bottleneck to efforts at

[1] Cash income is calculated as gross revenue minus cash expenditure on intermediate inputs.

[2] The increasing prominence of intercropping makes this calculation difficult. The above estimate calculates intercropping at 50% of actual surface area. Without discounting for intercropping, total actual surface area occupied by sorghum and beer bananas reaches 42% of cultivated land in the second agricultural season.
attaining food security over the next several decades (See World Bank, 1984).

In addition to considerable land area, bananas occupy the most fertile plots in the country (Champion, 1965, pp.30-32). Because bananas are typically planted closest to dwellings, the bulk of the organic waste from each homestead is returned to the banana plantations. Hence fertility differentials have increased over time as farmers funnel organic material disproportionately to their banana fields (Champion, 1965, pp.30-32). This further increases the opportunity cost of keeping land in beer banana production.

Nutritional properties constitute a final liability. While caloric loss is minimal in sorghum beer production, consumption of bananas in the form of wine entails about a 60% caloric loss (FAO Food Composition Tables, cited in Mihailov 1986a, p.35; and Christa Desert, personal communication July 1987).

Clearly Rwanda's alcoholic beverage subsector is an important one. It generates substantial income, employment, and tax revenue, yet at the same time engenders potentially important economic costs.

This study aims to explore opportunities for improving the economic performance of the alcoholic beverage subsector. The review begins by describing the market, the current supply system, and the dynamics of both. It then examines the impact of the current policy environment on both producers and consumers. The final section enumerates technical and policy interventions that might improve performance of this important segment of the Rwandan economy.
II. DEMAND FOR ALCOHOLIC BEVERAGES

A. Overview of the Market

Rwanda's alcoholic beverage market includes the following four categories of drink: banana wine, the bulk home-brewed plus a small portion industrially produced by OVIBAR; sorghum beer, all home-brewed; clear beer, virtually all domestically produced in BRALIRWA's modern factory; and imported wines, beers, whiskey, and liqueurs. As Table 1 indicates, the two home-brewed beverages—banana wine and sorghum beer—hold the lion's share of the market. Together they account for 90% of total volume and 80% of the value of all alcoholic beverages consumed.

Banana wine dominates the market, both within home brews and overall. Its consumption stands at double the volume of sorghum beer; and because it costs more than twice as much, the value of banana wine consumption is over four times that of sorghum beer.

Home brewers continue to supply the overwhelming majority of banana wine sold. The Rwandan government did, in 1977, establish a parastatal, the Office de Valorisation Industrielle de la Banane (OVIBAR), whose primary focus to date has been to produce bottled banana wine for sale on an industrial scale. Because of severe technical difficulties, a suspect initial plant layout, constrained operational latitude as a parastatal, painfully short working capital supplies, and the high price of their product, OVIBAR's sales have never reached even 1% of total national banana wine sales.

The Brasserie et Limonadierie du Rwanda (BRALIRWA) produces the second—and most important—category of industrially manufactured beverages in the country, standard western-recipe "clear" beer. BRALIRWA, a privately owned company controlled by the Heineken group, brews primarily a low-cost, low-alcohol beer called "Primus". However, in 1987, they did introduce a second brand, "Mitzig," which, with its fancier packaging and higher alcohol content, aims at a more up-scale market than Primus. Because reliable home brewing aggregates are only available for 1983, the year of the Ministry of Plan's National Household Budget and Consumption Survey (ENBC), most data in this review focus on that year. Hence Table 1 indicates, for 1983, that all locally produced clear beer was Primus. It accounts for about 20% of all final consumer expenditure on alcoholic beverages.

Imported beverages—wines, liqueurs, whiskies and even some clear beer—hold the smallest share of the Rwandan alcoholic beverage market, only about 1% of total sales. Within this category, whiskies and wines predominate. Although importers do bring in a small amount of clear beer from abroad, a 392% tariff ensures that such imports remain miniscule.

B. The Social Importance of Banana Wine and Sorghum Beer

Social customs centuries old confer on banana wine, and to a lesser extent sorghum beer, a privileged place in the consumer's demand profile. No ceremony is complete without banana wine. Custom demands it in dowries,
TABLE 1

PROFILE OF ALCOHOLIC BEVERAGE CONSUMPTION,
RWANDA 1983

<table>
<thead>
<tr>
<th>Beverage</th>
<th>Quantity</th>
<th>Price</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Million</td>
<td>Frw/liter</td>
<td>Million</td>
</tr>
<tr>
<td></td>
<td>liters</td>
<td></td>
<td>Frw</td>
</tr>
<tr>
<td>1. Banana Wine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. home brewed</td>
<td>359.8</td>
<td>43</td>
<td>15,471</td>
</tr>
<tr>
<td>b. Ovibar</td>
<td>.3</td>
<td>224</td>
<td>59</td>
</tr>
<tr>
<td>Total</td>
<td>360.1</td>
<td>15,530</td>
<td>64</td>
</tr>
<tr>
<td>2. Sorghum Beer</td>
<td>204.4</td>
<td>18</td>
<td>3,679</td>
</tr>
<tr>
<td>3. Clear Beer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Primus</td>
<td>55.4</td>
<td>117</td>
<td>4,654</td>
</tr>
<tr>
<td>b. imports</td>
<td>55.4</td>
<td>987</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>55.4</td>
<td>4,658</td>
<td>19</td>
</tr>
<tr>
<td>4. Imported wine,</td>
<td>.3</td>
<td>900</td>
<td>279</td>
</tr>
<tr>
<td>whiskey, liqueurs</td>
<td>==</td>
<td>==</td>
<td>==</td>
</tr>
<tr>
<td>Total</td>
<td>620.2</td>
<td>24,148</td>
<td>100</td>
</tr>
</tbody>
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Source: National Budget and Consumption Survey (ENBC), Ministry of Plan; BRALIRWA interviews; OVIBAR (1986); Ministry of Plan (MINIPLAN) (1987).
at weddings, funerals, and celebrations of all kind. In welcoming
visitors, Rwandans offer them banana wine, and reciprocal exchanges of
banana wine are preferred means of cementing social relationships. The
offering of banana wine is considered essential before advancing requests
for small favors or assistance of any sort. Mobilizing communal labor for
clearing fields, building homes or other labor-intensive tasks normally
requires that the beneficiary provide banana wine to those who assist (See
Tutsi preferences for a liquid diet, which reinforced their sense of
independence from the land, enhanced the status of beverages — banana wine,

Rwandans view banana plantations as a sign of wealth, security and
social status. In establishing a new homestead, they first plant banana
trees. They plant them close to their house to provide greenery, leaves,
bark and fiber as well as a source of food. The division of land among
children requires a partition of banana plantations as well.

As is so often the case, social prominence coincides with important
economic advantages (See Harris, 1970 for other examples). Bananas provide
a stable source of food because they yield all year round. They are
drought resistant and therefore offer an important measure of food
security; in years where other crops fail, bananas can be eaten rather than
brewed in order to maintain consumption levels at nutritionally adequate
levels. Banana trees, perrenials that may yield for generations, combat
erosion, soften rain falling on associated intercrops and demand little
attention. According to a recent World Bank study (see Appendix Table
A.1), bananas generate the highest returns to land and the third highest
returns to labor of any crop. Bananas are both socially preferred and
economically profitable.

C. A Consumption Profile

As an indicator of the relative importance of social and economic
motivations, Table 2 suggests that, while social considerations remain
important, economic concerns now dominate consumption and production
decisions. Home brewers sell fully 70% of their banana wine production and
over half of all sorghum beer. In value terms, this means that two-thirds of
all home-brewed beverages are produced for cash sale. The remaining
third can be considered socially motivated, about 20% given as gifts with
the remainder going for own consumption. Only about 1% apparently goes for
labor exchange and other forms of barter.

Consumption levels vary greatly between urban and rural areas.
Although virtually all banana wine and sorghum beer production takes place
in rural areas, brewers appear to export substantial quantities to urban
areas and to neighboring countries. Using ENBC data to compute rural
exports (rural production minus rural consumption) indicates that about 45%
of banana wine produced is exported from rural areas as is about 10% of all
sorghum beer (See Tables 1 and 13). In 1983, per capita rural consumption
of both home brewed beverages together stood at 73 liters (ENBC). At the
same time, urban consumption was much higher. If all rural exports of
sorghum beer and banana wine were consumed in urban Rwanda, per capita
urban consumption would come to an unbelievably high 770 liters per year,
TABLE 2

DISPOSITION OF HOME-BREWED BEVERAGES,
RWANDA 1983

(million liters)

<table>
<thead>
<tr>
<th></th>
<th>Banana Wine</th>
<th>Sorghum Beer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>Percent</td>
</tr>
<tr>
<td>1. Sales</td>
<td>251</td>
<td>70</td>
</tr>
<tr>
<td>2. Gifts</td>
<td>64</td>
<td>18</td>
</tr>
<tr>
<td>3. Own Consumption</td>
<td>42</td>
<td>12</td>
</tr>
<tr>
<td>4. Barter</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>360</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: National Budget and Consumption Survey (ENBC), Ministry of Plan.
over 2 liters per man, woman and child per day and ten times the level of rural consumption. Because substantial rural production is also exported to neighboring countries, especially from southeast Rwanda to Burundi and Zaire, urban consumption undoubtedly lies at a lower level. But under most reasonable assumptions about export volumes, per capita urban consumption would appear to lie at least at 350 liters per year or about five times the level of rural consumption.

Of course, it is also possible that rural consumption has been undercounted by ENBC. Consumption studies frequently do underestimate alcoholic beverage consumption; because much of the consumption takes place outside the household, and interviewees, typically housewives, are not normally the major consumers of alcoholic beverages and hence are unable to estimate intake accurately. If ENBC has underestimated rural consumption, beverage exports and also urban consumption may be overestimated. Thus these estimates of beverage exports and urban consumption must be used with some caution.

Of the rural consumption which is marketed, over 80% is sold in cabarets or market stalls. As Table 3 indicates, selling from households is prominent only for sorghum beer where 25% of sales take place in home-based retail outlets. Thus, unlike, many other African countries, Rwandans retail home-brewed beverages in specialized commercial outlets rather than home-based facilities (See Haggblade, 1987). While the urban component of the ENBC is not yet available for analysis, field interviews indicate that the predominance of cabarets and market stall sales is even more pronounced in urban than in rural areas.

Consumption profiles point to a generally even distribution of home brewed beverages across income levels, while consumers of Primus remain confined to the upper income quintile. As Table 4 indicates, over 90% of all rural households consume banana wine, with most consumption spread evenly among households. Although sorghum beer appears also evenly spread among consuming households, only 70% of all households consume sorghum beer. Given the large regional variation in sorghum, and hence sorghum beer, availability, some of the 30% abstention likely stems from regional difference, although some may be due to a taste preference or higher status conferred by banana wine. Primus consumption is skewed, with only one-fourth of rural households purchasing any at all. Table 5 corroborates these notions. While Primus expenditures rise substantially with income, both banana wine and sorghum beer spending declines as a percent of total household expenditure, and with sorghum beer even absolute expenditure remains essentially flat. This too points to taste preference for banana wine and Primus.

D. Consumption Parameters

The rural sample of the Ministry of Plan's (MINIPLAN) National Household Budget and Consumption Survey (ENBC) allows estimation of key demand parameters from their 270-household sample. Because MINIPLAN has not yet completed data input for the urban component of its survey, the following estimated elasticities refer only to rural consumers. However, once the urban data are analyzed it will be possible to make analogous estimates for urban households.
TABLE 3

LOCATION OF RURAL ALCOHOLIC BEVERAGE PURCHASES, RWANDA 1983

(value in Frw per household per year)

<table>
<thead>
<tr>
<th></th>
<th>Banana Wine</th>
<th>Sorghum Beer</th>
<th>Primus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Percent</td>
<td>Value</td>
</tr>
<tr>
<td>1. Cabarets</td>
<td>1,933</td>
<td>80</td>
<td>234</td>
</tr>
<tr>
<td>2. Market stall</td>
<td>172</td>
<td>7</td>
<td>117</td>
</tr>
<tr>
<td>3. Other households</td>
<td>141</td>
<td>6</td>
<td>148</td>
</tr>
<tr>
<td>4. Restaurant</td>
<td>35</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5. Other</td>
<td>132</td>
<td>5</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td>2,413</td>
<td>100</td>
<td>587</td>
</tr>
</tbody>
</table>

Source: National Budget and Consumption Survey (ENBC), Ministry of Plan.
TABLE 4

DISTRIBUTION OF RURAL BEVERAGE CONSUMPTION,
RWANDA 1983

(percent of households)

<table>
<thead>
<tr>
<th>Consumption [liters/household]</th>
<th>Banana Wine</th>
<th>Sorghum Beer</th>
<th>Primus</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9.1</td>
<td>29.3</td>
<td>75.9</td>
</tr>
<tr>
<td>1 - 120</td>
<td>64.1</td>
<td>55.8</td>
<td>24.1</td>
</tr>
<tr>
<td>251 - 500</td>
<td>19.8</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td>501 - 750</td>
<td>5.1</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>751 - 1,000</td>
<td>1.3</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>1,001 - 1,250</td>
<td>.6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1,251 - 1,750</td>
<td>0</td>
<td>.5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100 %</td>
<td>100 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>

Source: National Budget and Consumption Survey (ENBC), Ministry of Plan.
### TABLE 5

**RURAL CONSUMPTION PROFILE BY EXPENDITURE* QUINTILE, RWANDA 1983**

<table>
<thead>
<tr>
<th>Expenditure Quintiles</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Banana Wine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. FRw/HH/year</td>
<td>4,887</td>
<td>4,516</td>
<td>3,606</td>
<td>7,796</td>
<td>7,201</td>
</tr>
<tr>
<td>b. as % total HH exp.</td>
<td>13.7</td>
<td>8.8</td>
<td>6.6</td>
<td>12.0</td>
<td>7.3</td>
</tr>
<tr>
<td>c. liters/HH/year</td>
<td>166</td>
<td>134</td>
<td>115</td>
<td>256</td>
<td>247</td>
</tr>
<tr>
<td>2. Sorghum Beer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. FRw/HH/year</td>
<td>1,924</td>
<td>4,705</td>
<td>2,096</td>
<td>2,212</td>
<td>2,886</td>
</tr>
<tr>
<td>b. as % total HH exp.</td>
<td>5.4</td>
<td>9.2</td>
<td>3.8</td>
<td>3.4</td>
<td>2.9</td>
</tr>
<tr>
<td>c. liters/HH/year</td>
<td>134</td>
<td>282</td>
<td>150</td>
<td>149</td>
<td>161</td>
</tr>
<tr>
<td>3. Primus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. FRw/HH/year</td>
<td>156</td>
<td>304</td>
<td>15</td>
<td>574</td>
<td>2,468</td>
</tr>
<tr>
<td>b. as % total HH exp.</td>
<td>.4</td>
<td>.6</td>
<td>0</td>
<td>.9</td>
<td>2.5</td>
</tr>
<tr>
<td>c. liters/HH/year</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>4. Total Alcoholic Beverages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. FRw/HH/year</td>
<td>6,967</td>
<td>9,525</td>
<td>5,717</td>
<td>10,582</td>
<td>12,554</td>
</tr>
<tr>
<td>b. as % total HH exp.</td>
<td>19.6</td>
<td>18.6</td>
<td>10.4</td>
<td>16.2</td>
<td>12.8</td>
</tr>
<tr>
<td>c. liters/HH/year</td>
<td>302</td>
<td>419</td>
<td>265</td>
<td>410</td>
<td>429</td>
</tr>
<tr>
<td>5. Total Household Exp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(FRw/HH/year)</td>
<td>35,628</td>
<td>51,212</td>
<td>54,804</td>
<td>65,161</td>
<td>92,286</td>
</tr>
</tbody>
</table>

* Note: Expenditure includes cash purchases, imputed value of own consumption and gifts received.

Source: National Budget and Consumption Survey (ENBC), Ministry of Plan.
Simple demand equations have been estimated by regressing quantity of banana wine, sorghum beer and Primus on per capita household expenditure, the prices of all three beverages and a number of household characteristics thought to influence consumption patterns. After a first estimation, insignificant right-hand-side variables were dropped and the equation was rerun. Both quantity and price data have been expressed in natural logarithms, so the reported coefficients can be read directly as elasticities. In the results below, the numbers listed in parentheses are standard errors, ** indicates a coefficient significant at the 1% level and * denotes a coefficient significant at the 5% significance level:

(1) \( \text{QBW} = -6.4 - .64 \text{PRBW}^{**} + .97 \text{PRSB}^{**} + 1.0 \text{EXP}^{**} - .38 \text{FFH}^{*} \)
\[ \begin{align*}
& (\text{.23}) & (\text{.35}) & (\text{.15}) & (\text{.17}) \\
& + .87 \text{SIZE}^{**} - .0088 \text{SSUF}^{*} + .025 \text{VAB}^{**} \\
& (\text{.15}) & (\text{.0036}) & (\text{.0049}) \\
\end{align*} \]
\[ \hat{R}^2 = .37 \]

(2) \( \text{QSB} = -1.5 + 1.35 \text{PRBW}^{**} - 1.35 \text{PRSB}^{**} + .5 \text{EXP}^{*} - .08 \text{ED}^{*} \)
\[ \begin{align*}
& (\text{.37}) & (\text{.47}) & (\text{.21}) & (\text{.04}) \\
& + .55 \text{SIZE}^{**} - .013 \text{SSUF}^{*} + 1.02 \text{NW}^{**} + .6 \text{SC}^{**} \\
& (\text{.21}) & (\text{.006}) & (\text{.25}) & (\text{.23}) \\
\end{align*} \]
\[ \hat{R}^2 = .28 \]

(3) \( \text{QPR} = -7.98 - 6.11 \text{PRPR}^{*} + 3.46 \text{EXP}^{**} + 2.72 \text{SIZE}^{**} + .21 \text{ED}^{*} \)
\[ \begin{align*}
& (3.01) & (\text{.54}) & (\text{.50}) & (\text{.10}) \\
& - .09 \text{SSUF}^{*} \\
& (\text{.01}) \\
\end{align*} \]
\[ \hat{R}^2 = .62 \]

where variable definitions are as follows:

- \( \text{QBW} \) = natural logarithm \((\ln)\) of quantity of banana wine consumption, liters/household/year;
- \( \text{QSB} \) = \(\ln\) quantity of sorghum beer consumption, liters/household/year;
- \( \text{QPR} \) = \(\ln\) quantity of Primus consumption, liters/household/year;
- \( \text{PRBW} \) = \(\ln\) price of banana wine, FRw/liter;
- \( \text{PRSB} \) = \(\ln\) price of sorghum beer, FRw/liter;
- \( \text{PRPR} \) = \(\ln\) price of Primus, FRw/liter;
- \( \text{EXP} \) = total per capita household expenditure per year \((\ln)\), includes own production, cash expenditure and gifts received;
FHH = dummy variable, 1 = female-headed households, 0 = male-headed;
SIZE = number of persons per household (ln);
SSUF = home production/total household consumption;
VAB = percent of total household income earned by selling alcoholic
    beverages;
ED = number of years of schooling of head of household;
NW = dummy variable, 1 = northwest region;
SC = dummy variable, 1 = southcentral region;
DIST = distance from nearest market, in 15 minute intervals.

Several conclusions emerge from these data. First, price sensitivity
of demand varies significantly among the three beverages studied. Own
price elasticities of demand range from .6 for banana wine, 1.4 for sorghum
beer and 6.1 for Primus. This means, in the case of Primus, that the
quantity of Primus purchased by consumers will fall 6.1% for each 1%
increase in its price. Thus Primus is by far the most price sensitive of
three beverages, while banana wine consumption is the least.

Competition among beverages is measured econometrically by the cross
price elasticities of demand. Because neither the price of banana wine nor
the price of sorghum beer affects Primus consumption, it appears that, in
the short run at least, neither is a close substitute for clear beer.
Primus consumption depends primarily on income rather than the price of
competing products. But banana wine and sorghum beer are close
substitutes; price increases in one product increase consumption of the
other.

Finally, these demand equations provide insights into the effects of
rising income on beverage demand. They clearly foreshadow the growing
importance of Primus as incomes rise. The income elasticity of demand for
Primus equals about 3.5, indicating that a 1% increase in income will lead
to a 3.5% increase in the quantity purchased. This far exceeds income
responsiveness of home-brewed beverage consumption, especially that of
sorghum beer. Demand for banana wine is of unitary income elasticity, its
income elasticity standing at 1. But the demand for sorghum beer is income
inelastic. A 1% increase in income leads to only a .5% increase in the
volume of sorghum beer demanded. These consumption parameters will be used
in subsequent sections to help predict subsector dynamics as well as the
impact of government policy on the subsector.
III. PRODUCT CHARACTERISTICS AND TECHNOLOGY OF PRODUCTION

A. Product Characteristics

Banana wine, called "urwagwa" in kinyarwanda and also frequently labelled "banana beer", remains the most popular drink in Rwanda. Produced by fermenting banana juice and adding small quantities of toasted sorghum, banana wine is a slightly sour, cloudy beverage coming in a range of pinkish-tan hues. It is opaque because brewers pass it through only a very coarse filter leaving banana solids and sorghum starches in solution.

Although broadly similar, banana wines differ in taste, color and texture from region to region and brewer to brewer depending on the variety of banana used, the soil type in which the banana trees grow, the amount of sorghum and water added, and slight (and closely guarded secret) variations practiced by individual brewers. Consumers readily identify these slight differences, and many exhibit clear preferences for one over another. Many cabaret owners maintain a loyal clientele by maintaining a consistent type of banana wine. To do so requires careful quality-control tasting of banana wine before they purchase it for resale.

Sorghum beer resembles banana wine in some ways: both taste sour, although sorghum beer more so, and both are opaque from the large quantity of solids remaining in solution. Sorghum beer is normally a thicker beverage, and depending on dilution rates it may resemble a thin porridge in consistency. Because the ratio of sorghum to other inputs is far greater in sorghum beer than in banana wine and because that used in sorghum beer is smeared with ashes during malting, the color of sorghum beer frequently tends to darker charcoal-tinted pinks than does banana wine. An actively fermenting beverage, sorghum beer has a distinctly effervescent character; large drums of beer bubble conspicuously. As with banana wine, recipes vary. The range of sorghum-based beverages runs from unfermented thin porridge to bubbly, fully fermented sorghum beer.

In comparing the alcoholic beverages available in Rwanda, several important distinctions emerge. First, alcohol content varies substantially among beverages, from 2-4% in sorghum beer to 4% in Primus, 5% in Mitzig and what is commonly a 6-8% range in ordinary banana wine (Munyangendo 1984,pp.22,24). But standard banana wine is diluted by adding to a given volume of pure banana juice an additional 50 to 100% water. Undiluted, high-priced banana wine produced by some home brewers on special order or for own consumption, as well as the undiluted wine produced by OVIBAR and several emerging small industrial wine manufacturers, attains alcohol content of between 10 and 12% (OVIBAR 1986, p.53).

Nutritional value also varies considerably. Here again sorghum beer emerges as the most healthy beverage. It contains 1,170 kilocalories per liter compared to 620 for banana wine and 430 for Primus (FAO Food Composition Tables, cited in Mihailov 1986a, p.35).

The shelf life of each beverage strongly affects the distribution system and coordination required between producer and retailer. Sorghum beer and standard banana wine spoil most quickly, normally within 2 to 4
days (Champion 1965, p.22; Munyangendo 1984, p.2; Haggblade 1987). High-quality banana wine will last much longer, up to six weeks for undiluted wine and many years if it is pasteurized, as at OVIDAR and in some church production units (Mihailov 1986a, p.26; Treutens 1986, p.5; OVIDAR interview 7/87).

B. Technology of Producing Banana Wine

Table 6 describes the procedures followed in producing banana wine as well as the purpose of each step. The same sequence is followed by home brewers - even the small cadre of emerging large-scale home producers - as well as OVIDAR. But differences between the scale of home brewing and OVIDAR's factory production are large; while home brewers ferment banana wine in 50- to 250-liter wooden troughs, OVIDAR uses 24,000-liter stainless steel tanks. And this size difference does lead to slight modifications in procedure. In ripening their bananas, OVIDAR and the large home brewers do not require hot ashes to stimulate ripening, because the volume of bananas they place in close proximity generate sufficient heat on their own. At the mixing stage, too, where home brewers squeeze banana pulp by hand, OVIDAR instead uses a high-speed blender and mechanical press. And an intermediate mixing technology, a simple, hand operated banana crushing machine has been developed by a Rwandan entrepreneur who reportedly uses it in producing banana wine himself.

The only significant procedural difference between OVIDAR's winery and the home producers is that OVIDAR pasteurizes its wine to arrest fermentation and sterilize the beverage, thus increasing its shelf life. Some Catholic missions that produce banana wine for sale and for own consumption also pasteurize it to lengthen the shelf life of their wine.

The crucial step in banana wine production is juice extraction, the mixing stage. It has long been recognized that the key to economy in brewing lies in the volume of juice expelled per kilogram of bananas used (Champion 1965, p.53; Munyanganizizi 1975, p.29). Section D below reviews evidence on the current extraction rates and prospects for raising them.

C. Technology of Producing Sorghum Beer

In Rwanda, sorghum beer is produced exclusively by home brewers. They do so following the procedures described in Table 7.

Malting, the first step in brewing, is also the most important. As with any other grain, sorghum is malted simply by soaking it in water, allowing the grain to germinate for a few days, then drying and milling it. Unlike sorghum maltsters in other African countries, Rwanda's maltsters rub the damp sorghum with banana bark ashes before spreading the grain out to germinate. Maltsters and home brewers agree that omission of the ashes will prevent fermentation. Although laboratory testing would be required to clearly identify the biochemical function of the ashes, it is possible that they neutralize tannins in the sorghum, substances which would otherwise inhibit germination. In Zimbabwe, South Africa and Botswana, sorghum maltsters use a low-dosage formaldehyde steep for that same purpose (Haggblade and Holzapfel, 1987).
**TABLE 6**

**TECHNOLOGY OF PRODUCING BANANA WINE**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Purpose</td>
<td>- virtually total conversion of fruit starches to fermentable sugars</td>
<td>- extract juice from pulp</td>
<td>- separate juice from solid residue</td>
<td>- provides food for yeasts*</td>
<td>- yeasts feed off sugars to produce alcohol and carbon dioxide</td>
</tr>
<tr>
<td></td>
<td>- formation of soluble pectins which enclose juice in softened cell walls</td>
<td>- probable transfer of yeasts from peels to pulp</td>
<td>- dilute to increase volume of wine produced</td>
<td>- may be source of yeasts*</td>
<td>- yeasts available from:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- pectins render extraction difficult</td>
<td>- flavors brew</td>
<td>- sorghum unmalted, hence provides no diastatic enzymes for further starch breakdown</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- grasses provide mechanical friction necessary for juice extraction</td>
<td></td>
<td></td>
<td>a) peels (transfer during mixing)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>b) possibly from sorghum</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>c) inoculation with small quantity of previous batch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>d) inoculation from fermenting vessel</td>
</tr>
</tbody>
</table>

**B. Home Brewing Procedures**

- dig pit
- build fire or place hot cinders in hole
- cover cinders with banana leaves
- place banana regimes in pit
- cover with earth
- leave 4-7 days

- unearth regimes
- peel bananas
- pop pulp into large wooden basin
- add large quantity of long grasses
- squeeze mixture by hand
- some use jacob's ladder to improve yield

- wring out grasses
- filter juice through grass covered hole in clay vessel
- add water if desired (25-100% water:juice dilutions most common)
- grill sorghum in iron pan (like popping corn)
- mull
- add to juice/water mixture

- allow to ferment 1-2 days
- serve or transfer to jerrycans for sale at distribution centers

---

* Teutens (1986), p.115 believes the grilled sorghum is a source of yeast. Munyananganizi (1975), p.23 asserts that toasting the grain kills yeasts. Munyangendo (1983), p.21 notes that brewers insist sorghum is essential for fermentation. He suggests that, while probably not furnishing wild yeasts, the sorghum likely does furnish nutrients on which the yeasts feed.

Source: Munyananganizi (1975), Teutens (1986), Munyangendo (1983) and field interviews.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Purpose</td>
<td>- produces diastatic enzymes capable of converting grain starches to sugars</td>
<td>- dilute with water</td>
<td>- solubilizes malt starches</td>
<td>- enzymatic breakdown of malt starches to sugars</td>
<td>- removes coarse particles and dregs from brew</td>
</tr>
<tr>
<td></td>
<td>- partial conversion of grain starches to sugar (maltose)</td>
<td>- add additional malt</td>
<td>- produces highly active yeast innoculant</td>
<td>- yeasts convert sugars to alcohol</td>
<td>- second lactic acid fermentation</td>
</tr>
<tr>
<td></td>
<td>- synthesizes B-vitamins</td>
<td>- allow to ferment (1 day)</td>
<td>- probably simultaneous fermentation for lactic acid which:</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>- addition of ashes may neutralize tannins or other inhibitors of germination</td>
<td>- may be recooked with more malt added if necessary to produce active innoculant</td>
<td>a) lowers pH of the beer</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b) inhibits growth of pathogenic bacteria</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>c) confers sour taste on brew</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

B. Home Brewing Procedures
- soak sorghum grain for 1-2 days
- drain water
- mix with ashes from banana bark
- spread on ground in piles 6-15 cm. thick
- cover with damp grass mats or burlap bags
- allow to germinate until roots and shoots about 3 cm. long (1-3 days)
- spread to dry in sun
- mill

- boil small quantity of malt and water (1/2 hour)
- dilute with water
- boil big drum of water
- add large quantity of water
- boil 1-2 hours
- accelerate cooling by pouring cooling water into several shallow containers
- reconsolidate mash in one drum
- add innoculant to mash
- allow to ferment about 1 day
- filter
- serve or transfer to jerrycans for transport to distribution center

Malting is crucial to successful and economical brewing because of the diastatic enzymes synthesized during germination. It is these enzymes that break down grain starches to sugar, enabling yeasts to subsequently convert the sugars to alcohol. High concentrations of diastatic enzymes in malt leads to high quality malt which can more rapidly and more completely convert grain starches to sugars. High-diastatic malt improves the consistency and quality of sorghum beer by speeding the starch-to-sugar conversion and thereby diminishing prospects of airborne infestation by the bacteria which lead ultimately to spoilage and short shelf life. Good malt can also dramatically reduce grain requirements. By more completely converting grain starches to sugars, it enables brewers to produce a given quantity of beer with less grain than they would otherwise need.

D. Prospects for Increasing Technical Efficiency of Brewers

In the home production of both banana wine and sorghum beer, there appears to be substantial scope for increasing efficiency. The key, in both cases, lies in reducing the quantity of raw materials used to produce a given volume of beverage.

In producing banana wine, the amount of juice squeezed out of each kilo of bananas determines the volume of wine that can be produced. Regardless of dilution rates, more juice means more wine. The data in Table 8 indicate that home brewers currently extract about 30-55 liters of banana juice from 100 kg of peeled bananas. But OVIBAR extracts 73 liters, and laboratory experiments have succeeded in raising extraction rates to 85.

While other fruits - apples, grapes and citrus fruits - readily yield their juice when squeezed, bananas do not. The difference lies in pectins which are formed as the bananas ripen. The pectins, located primarily in cell walls, render the cells gelatin-like - rubbery and pliable but difficult to burst open.

To break the cell walls and release the juice inside, home brewers rely on friction. They add to the mixing basin long grasses which provide the friction necessary to hold rubbery banana cells in place so they can be burst open by pressure from strong hands. The grasses serve the same function as the fibrous cell walls in apples, citrus and other fruit.

Laboratory researchers and OVIBAR staff raise extraction rates in a different way. They directly address the source of the low yield problem by removing the pectins. They can do this in three ways: by applying heat, by precipitating them out with lime, or by using certain kinds of enzymes which break the pectins down. Table 9 compares the effectiveness of each method, summarizing the more detailed laboratory evidence listed in Appendix Table A.2. The data clearly indicate that fibers and heat are far less effective in raising extraction rates than are lime (CaO) and pectinic enzymes.

Comparing lime and enzymes, the two effective means of breaking pectins down, enzymes appear most likely to be easily adopted under current home brewing conditions. While brewers could use lime (CaO) to precipitate out the pectins, doing so raises the pH of the wine and alters its flavor substantially. To return the juice to its normal pH and taste requires
<table>
<thead>
<tr>
<th>1. Banana Wine</th>
<th>Extraction Rate (liters of juice/kg peeled bananas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. laboratory</td>
<td>.85</td>
</tr>
<tr>
<td>b. Ovibar</td>
<td>.73</td>
</tr>
<tr>
<td>c. home brewers</td>
<td>.29 - .54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Sorghum Beer</th>
<th>Conversion Rate (liters of beer/kg of cereal inputs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. industrial production with &quot;municipal&quot; malt, (Botswana, South Africa)</td>
<td>6.7</td>
</tr>
<tr>
<td>b. home brewing with &quot;trade&quot; malt, (Botswana)</td>
<td>6.4</td>
</tr>
<tr>
<td>c. home brewing with home-made malt, (Botswana)</td>
<td>4</td>
</tr>
<tr>
<td>d. home brewing with home-made malt, (Rwanda)</td>
<td>3 (2 - 4)</td>
</tr>
</tbody>
</table>

## TABLE 9

BANANA JUICE EXTRACTION RATES
UNDER LABORATORY CONDITIONS,
WITH AND WITHOUT ENZYME TREATMENT

(juice extracted as percent of peeled banana weight)

<table>
<thead>
<tr>
<th>Mechanical Pressure (kg/cm²)</th>
<th>80</th>
<th>300</th>
</tr>
</thead>
</table>

1. Without enzymes

   a. pressure only, peeled fruit
      (room temperature, approx. 21 deg. C.)
      0%  0%

   b. pressure only, fiber plus fruit
      (unpeeled fruit, room temperature)
      22%  33%

   c. heat plus pressure
      (peeled fruit, autoclaved 1 kg for 10 minutes)
      -   40%

   d. CaO plus pressure
      (.25% concentration, peeled fruit, room temperature)
      76%  86%

2. With enzyme treatment

   a. enzymes plus pressure
      (peeled fruit, 30 degrees C.)
      80%  87%

that they subsequently add hydrochloric or other acids to the juice after removing the pectins. OVIBAR technicians recommend against trying to teach home brewers how to measure out the correct dosage of acids.

The use of enzymes appears safer and easier. Altering none of their current equipment or procedures, home brewers could simply add a packet of pectinase enzymes (in powder or liquid form) and squeeze as normal. The result should be more juice than normal from an identical quantity of bananas. Because temperature and pH affect enzyme activity, and since home brewers will be less able to control these environmental factors, they will probably not be able to achieve the full theoretical efficiency gains achieved in laboratory conditions. Even OVIBAR does not. But there do exist simple ways of regulating temperature, and with some experimentation it should be possible to determine what enzyme dosages and conditions yield optimal results under home brewer conditions. The crucial empirical question is: How much will enzymes raise extraction rates under home brewer conditions? While that question can only be answered through field trials, the potential clearly exists. Even if home brewers can only raise extraction rates from their current roughly 40% level up to 60%, still well below the laboratory and OVIBAR rates, the gains would be considerable. And OVIBAR extraction rates may not be a ceiling on what home brewers can expect, because problems with OVIBAR's mechanical blender have led to uneven enzyme distribution, an area in which hand mixing may prove to have a technical edge. The current disparity between home brewer extraction rates and technical maxima is sufficiently large that capturing even a small increment of that differential would prove significant. Section VIII examines the economic viability of enzyme use by home brewers.

Similarly with sorghum beer, Rwanda's home brewers achieve conversion levels far below those attained elsewhere. As Table 8 indicates, the key to increasing home brewer efficiency in Southern Africa has been the introduction of "trade" malt, an intermediate-quality sorghum malt produced in simple, outdoor facilities with a minimum of equipment. To produce medium-quality diastatic sorghum malt requires controlling the four factors that most affect malt quality: sorghum variety, tannin content, moisture and temperature during germination. The best malting varieties of sorghum can be identified through simple laboratory germination tests. Tannin content is controlled by using a low-concentration formaldheyde steep, and trade maltsters can control temperature and humidity during germination, even outdoors, by regulating the thickness of the malting mounds, turning the sorghum to ensure even germination, and regulating humidity through the use of hoses and dampened burlap bags.

As with enzymes for banana wine producers, adoption of trade malt by home brewers of sorghum beer requires no change of equipment or procedures. It merely requires that home brewers substitute trade malt for malt they currently produce themselves. If Rwandan brewers can achieve the same efficiency gains achieved by home brewers in Botswana, it will be possible for them to reduce sorghum inputs by about 35%. The beer will remain of identical quality. Only the huge volume dregs, the unconverted grain starch that that brewers remove when filtering their beer, will be reduced. While laboratory testing of local sorghum varieties and field trials with imported or locally produced trade malt will be required to measure the portion of potential savings that can be captured, the gap, as with banana
wine, appears sufficiently large that the opportunity should be explored. Section VIII suggests ways of doing this.

IV. STRUCTURE OF THE SUPPLY SYSTEM

A. The Basic Subsector Map

The subsector map sketched in Figure A describes the major channels through which Rwanda's brewers procure raw materials, produce beverages and distribute them to consumers. As it shows, seven principal channels provision Rwanda's alcoholic beverage market. Three supply banana wine, two sorghum beer, one Primus and one imported hard liquors, liqueurs and wines.

The employment overlay echoes and amplifies the impression left by sales figures: that home brewed beverages dominate the market. They supply 80% of the value of all alcoholic beverages and 96% of all subsector employment. Given in full-time equivalents, the employment figures indicate that banana wine supports two-thirds of total subsector employment, sorghum beer a further 30%, and Primus plus imported drinks the remaining 4%. Because most banana wine and sorghum beer employment is part-time, the income earned in those channels is spread over a far larger number of individuals than even the employment figures suggest.

Because the major banana wine and sorghum beer channels are so similar, they are most easily described together. The non-market channels, 3b and 4b, represent the one-third of home brew that is consumed directly by producing families or given as gifts to others.

The home-brewed beverages that pass through market channels, 3c and 4a, flow through similar, though sometimes parallel, distribution systems. Both channels begin in rural areas where virtually all Rwanda's banana wine and sorghum beer is produced. Field interviews with producers and cabaret owners indicate that a minute portion of sorghum beer is produced in urban areas, but the great bulk of what is sold in towns is imported daily from rural areas. Although the share of home brewers that purchase the sorghum and bananas they use in brewing cannot be quantified exactly, it appears that marketing of inputs is more prevalent among sorghum beer producers than for makers of banana wine. Brewers complain that beer bananas are difficult to find in markets; most owners of banana trees prefer to make their own banana wine, either for own consumption or for sale, and are willing to market only the left-over bunches insufficient to produce a normal batch. A very small emerging number of specialized banana wine producers must resort to special purchasing trips in search of surplus beer bananas. Certainly sorghum is more widely marketed than beer bananas. And people have begun to market sorghum malt as well.

Table 10 reinforces the notion of banana wine production spread across a large number of small-scale producers, most of whom simply brew the fruit of their own plantations. The table indicates that banana wine production
Figure A. (cont.)

RWANDA'S ALCOHOLIC BEVERAGE SUBSECTOR:

BASIC SUBSECTOR MAP

= enterprise boundary

= enterprise vertically integrated across several functions

= function implicitly performed within a vertically integrated firm

= enterprises employing identical technology in performing a given function

= sale in spot market

= distribution point

M FRw = millions of Rwandan francs

N = number of enterprises

L = employment in full-time equivalents
TABLE 10

DISTRIBUTION OF PRODUCTION ACROSS HOME BREWING HOUSEHOLDS, RWANDA 1983

<table>
<thead>
<tr>
<th>Annual Production (liters/HH/year)</th>
<th>Banana Wine % HH % Prodn.</th>
<th>Sorghum Beer % HH % Prodn.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>17.0 0</td>
<td>43.8 0</td>
</tr>
<tr>
<td>1 - 250</td>
<td>35.9 11.7</td>
<td>34.0 14.9</td>
</tr>
<tr>
<td>251 - 500</td>
<td>25.0 26.8</td>
<td>11.8 20.7</td>
</tr>
<tr>
<td>501 - 750</td>
<td>7.7 13.5</td>
<td>4.1 12.7</td>
</tr>
<tr>
<td>751 - 1,000</td>
<td>5.3 13.2</td>
<td>1.4 6.2</td>
</tr>
<tr>
<td>1,001 - 1,250</td>
<td>4.8 14.8</td>
<td>1.3 7.7</td>
</tr>
<tr>
<td>1,251 - 1,500</td>
<td>1.9 7.4</td>
<td>1.3 9.6</td>
</tr>
<tr>
<td>1,501 - 1,750</td>
<td>.8 3.9</td>
<td>1.0 8.6</td>
</tr>
<tr>
<td>1,751 - 2,000</td>
<td>1.0 5.6</td>
<td>.3 2.9</td>
</tr>
<tr>
<td>2,000 +</td>
<td>.5 3.2</td>
<td>1.0 17.0</td>
</tr>
<tr>
<td>Total</td>
<td>100 % 100 %</td>
<td>100 % 100 %</td>
</tr>
</tbody>
</table>

Source: National Budget and Consumption Survey (ENBC), Ministry of Plan.
is spread far more evenly across rural households than is sorghum beer. Fully 83% of all rural households brew banana wine with the bulk of production concentrated among households brewing less than 750 liters per year liters per year. Households producing over 1,500 liters per year account for only 13% of banana wine output. In contrast, only 56% of all rural households brew sorghum beer with 28% of production concentrated in households brewing over 1,500 liters per year.

The evidence in Table 10 corroborates impressions gained during fieldwork: that specialized, large-scale home brewers do exist, particularly among sorghum beer producers. The most active 10% of banana wine producers account for 35% of total production. But among producers of sorghum beer, the top 10% of brewers manufacture 65% of total output.

As soon as their brew is ready, producers who export to urban areas or out of the country deliver their production to well-known distribution centers, displayed as large black dots on the subsector map. Distribution points operate daily between about 5:30 and 9:00 a.m. on the periphery of all large towns and at the edge of major exporting regions. If located within a 15 to 20 kilometer radius from the distribution point, producers normally deliver their brew by bicycle in 40-liter jerrycans. Those traveling longer distances carry 20-liter jerrycans in inter-city taxis, or they make special arrangements with transporters going to the distribution center.

Cabaret owners travel daily to their preferred distribution center. Because banana wine and sorghum beer distribution points are normally separate, cabaret owners who wish to offer both must make two stops. They normally travel early in the morning by public transport, carrying empty 20- or 120-liter containers with them. Upon arrival they make the rounds of producers, carefully tasting individual brews with straws to ensure that quality and taste standards match those of their consumers. After negotiating the price of an acceptable brew, they transfer the purchased drink into their empty drum. Most cabaret owners have standing arrangements with truckers who transport them back to town with their full drums.

A striking feature of this distribution system is the absence of intermediaries. Virtually all transactions take place during face-to-face meetings of producer and retailer. Although in isolated cases, intermediaries may assemble a stock by purchasing from producers and trying to resell to cabaret owners, this appears to be extremely rare. Thin profit margins, product perishability and retailer insistence on themselves tasting the brew they are to sell make direct negotiation between producer and retailer almost essential. The regularity of distribution point operation and the small geographic distances to be covered in Rwanda enable such a system to exist.

The sorghum beer and banana wine distribution system appears to operate with remarkable efficiency. Costs of transport are kept to an absolute minimum through use of bicycles and public transport. Competition seems keen at distribution centers and among cabarets. While at the production level some brews fail to ferment, once a successful brew enters the marketing system it rarely has to be thrown out because of spoilage.
Occasionally producers arrive at distribution points late or misjudge demand (which varies considerably along weekly, monthly and annual cycles) and so have to return the following day to sell their brew. Producers who face such bad luck a second day often have to return and drink their production themselves or give it to friends. But cabaret owners indicate that they virtually never have to discard wine or beer they purchase for resale. Given the two to three day shelf life of the beverages, the low level of waste in the distribution system seems remarkable.

In cabarets, owners serve their beverages from large drums, measuring them out into standard receptacles, commonly the 72 cl. Primus bottle. Patrons drink from a straw and frequently pass a communal bottle among a group of friends. Most are simply furnished with wooden benches and little else. Atmosphere depends on the clientele, and social interaction is an important part of a visit to the cabaret. While a substantial number of cabarets sell both banana wine and sorghum beer, more specialize in one or the other. In part this segregation reflects consumer preference for one drink or the other, and in part it results from cabaret owner preference for dealing through a single distribution center. Some cabaret owners sell Primus, soft drinks and whiskey alongside home-brewed beverages, but the bulk of home brew is retailed separately from industrially manufactured beverages.

The Primus production/distribution channel operates along classic lines. Rwanda's single brewery imports barley malt, hops, bottles and other key inputs from which it manufactures and beer. Under government pressure, BRALIRWA has begun incorporating locally grown sorghum as up to 5% of its grain input. It is doubtful that BRALIRWA can increase this percentage appreciably because of tanins and hulls on the sorghum and because the barley malt they import is prepared according to international specifications geared at achieving an appropriate balance between diastatic enzymes and starches taking account only of the starches present in the barley malt.

BRALIRWA brews in Gisenyi and sells to wholesalers from there or Kigali. The brewery undertakes no other distribution. Wholesalers and retailers operate as independent businesspersons, although the Ministry of Finance fixes legal commercial margins for wholesaler and retailer.

Importers of European wines and liquors operate in much the same fashion. They distribute their imports through the normal retail network. OVIBAR and several new small bottlers of banana wine market directly through hotels and bars.

B. Characteristics of Producers

Policy makers will benefit from an understanding of the economic options facing subsector participants, since equity considerations in many cases magnify the importance of certain categories of actors. Table 11 gives, for home brewers, a profile of banana wine and sorghum beer revenues by income level. It indicates that the importance of banana wine and sorghum beer production remains essentially constant across income quintiles. Home brewed beverages account for about 20% of household revenues for the bottom four quintiles and drop to 15% only in the fifth.
**TABLE 11**

**HOME BREWER PRODUCTION* BY EXPENDITURE QUINTILE,**
**RWANDA 1983**

<table>
<thead>
<tr>
<th>Quintiles</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Banana Wine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. FRw/HH/year</td>
<td>5,666</td>
<td>6,638</td>
<td>8,961</td>
<td>11,657</td>
<td>11,288</td>
</tr>
<tr>
<td><em>b. as % total HH prodn.</em>*</td>
<td>15.9</td>
<td>13.0</td>
<td>16.4</td>
<td>17.9</td>
<td>11.5</td>
</tr>
<tr>
<td>c. as % beverage prodn.</td>
<td>79.0</td>
<td>71.0</td>
<td>73.0</td>
<td>80.0</td>
<td>79.0</td>
</tr>
<tr>
<td>d. liters/HH/year</td>
<td>216</td>
<td>255</td>
<td>353</td>
<td>452</td>
<td>460</td>
</tr>
</tbody>
</table>

| 2. Sorghum Beer | | | | | |
| a. FRw/HH/year | 1,511 | 2,703 | 3,338 | 2,846 | 3,043 |
| *b. as % total HH prodn.** | 4.7 | 5.3 | 6.1 | 4.4 | 3.1 |
| c. as % beverage prodn. | 21.0 | 29.0 | 27.0 | 20.0 | 21.0 |
| d. liters/HH/year | 102 | 191 | 240 | 203 | 250 |

| 3. Total Banana Wine plus Sorghum Beer | | | | | |
| a. FRw/HH/year | 7,177 | 9,341 | 12,298 | 14,504 | 14,331 |
| *b. as % total HH prodn.** | 20.0 | 18.2 | 22.4 | 22.2 | 14.6 |
| c. as % beverage prodn. | 100 % | 100 % | 100 % | 100 % | 100 % |
| d. liters/HH/year | 318 | 446 | 593 | 655 | 709 |

| 4. Value of Total Household Production* | | | | | |
| (FRw/HH/year) | 35,885 | 51,324 | 54,902 | 65,333 | 98,158 |

*Note: Production includes imputed value of own consumption plus gifts given plus sales.

**Note: Gross sales of home-made beer and wine include the value of crops used in their production. Most households use their own sorghum and bananas in beverage production. Hence, these figures should not be misconstrued as representing value added in home brewing.

Source: National Budget and Consumption Survey (ENBC), Ministry of Plan.
While Table 11 includes cash revenue plus the value of own consumption, Table 12 explores the relationship between home brewing and household access to cash income, using a sample of 62 families near Gisenyi. The data indicate that households without access to other regular sources of cash income are more likely to sell banana wine than are households with salaried workers. Lack of alternative sources of cash, it appears, drives households to sell beer. A regression, using ENBC data, of the share of beer-related income to total households earnings corroborates this view. It produces only one significant correlation, a negative relationship between education of household head and brewing income. Households with less educated heads of family are likely to have less cash income and hence be more inclined to sell beer instead.

V. SEASONAL AND REGIONAL DIFFERENCES

A. Seasonality

Forces on both the supply and the demand side of the market lead to seasonal movements in quantities and prices of beverages sold. Demand increases regularly on weekends, at the end of each month after payday, and over holiday seasons. This leads to the observed substantial price increases in banana wine at Christmas time. The lack of price rise in sorghum beer at that time may stem from its undoubtedly much higher supply elasticity. Sorghum can be stored after harvest and brewed in varying quantities in response to demand patterns throughout the year. But bananas spoil; and because they ripen not all at once but throughout the year, they can only be brewed as they ripen over the course of the year. Consumer preference for banana wine for ceremonial purposes may also contribute to the banana price rise in December. The flatPrimus price year-round attests to the effectiveness of Ministry of Finance price control legislation - or at least to the bar owners' adeptness in spotting price survey agents.

Supply side variations affect primarily sorghum beer but also banana wine to some extent. Primus production, of course, proceeds year-round unaffected by weather or poor harvests. Banana trees produce fruit throughout the year, but with distinct production peaks four to five months following the major rains. Hence banana's trees yield most from August through October and least in May and June with trough-to-peak increases on the order of 50% (Delepiere 1970, pp.10,11.) Because of bananas' perishability, banana wine production is tied to the seasonal rhythm of banana production. But farmers plant virtually all sorghum as a second season crop, harvesting it in June and July. The abundance of sorghum at harvest time drives prices to seasonal lows, making sorghum beer likewise least expensive at that time. Hence sorghum beer volumes are undoubtedly highest, and its price lowest, immediately after harvest. As Figure B indicates, this seasonal supply bulge is reflected in the annual sorghum beer price trough in June, July and August.
TABLE 12

RELATIONSHIP BETWEEN
ALTERNATIVE INCOME EARNING OPPORTUNITIES
AND HOME BREWING IN TWO VILLAGES* IN
KANAMA COMMUNE, GISENYI, RWANDA 1981

1. Household Characteristics
   a. Percent HH's with
      salaried members
      Nyamugali: 53%
      Kagera: 31%
   b. Average cash income
      per HH per month
      Nyamugali: 7,793 FRw
      Kagera: 2,839 FRw

2. Banana Wine Earnings
   a. Percent HH's for whom
      home brewing generates
      over 50% of cash revenue
      Nyamugali: 10%
      Kagera: 57%
   b. Percent HH's which
      never brew
      Nyamugali: 37%
      Kagera: 0%
   c. Banana wine revenue
      per HH per month
      Nyamugali: 632 FRw
      Kagera: 880 FRw

*Note: Sample includes 62 households.

FIGURE B.

SEASONALITY IN

ALCOHOLIC BEVERAGE PRICES, KIGALI 1983

Prices (FRW per 72 cl. bottle)

MONTHS

J F M A M J J A S O N D

 Banana Wine

Sorghum Beer

Primus

Source: Ministry of Plan, Statistics Division.
B. Regional Differences

Rwanda is commonly divided into five geographic zones as described in Figure C. As Table 13 shows, brewers in the Eastern Region, the largest producer of bananas in the country, brew about 100 liters of banana wine per person per year, substantially more than any other region. The East also exports banana wine, primarily to Kigali, at the greatest rate of any region. With sorghum beer, the Northwest Region, a surplus sorghum producer, produces and exports sorghum beer at a higher rate than any other area of the country. Production in the North West reaches about 100 liters of sorghum beer per person per year, double the rate in the Southcentral Region, the second largest producing area. The only surprise in the regional data are the sorghum beer figures for the East. Although a large surplus sorghum-producing region, the ENBC data indicate that the East is a net importer of sorghum beer. If correct, these data imply that the East exports sorghum and re-imports sorghum beer.

The regional price data in Table 14 paint a similar picture. The East, region of greatest banana and banana beer production, maintains a banana wine price one-half the level prevailing elsewhere in the country. Similarly the Northwest and Southcentral regions, the two major sorghum beer producing areas, experience sorghum beer prices substantially below the national average.

Primus and whiskey prices vary primarily because of transport cost differentials. Produced in Gisenyi, Primus retails at its lowest price there; while imported liquors clear customs in Kigali, resulting in the lowest price there and regional differentials based on varying transport costs and differences in the intensity of competition across regions.

The regional price spreads lead to wide variation in relative beverage prices across regions. While, on average, banana wine retails at about double the price of sorghum beer, that ratio rises to over 4 in the Southcentral Region, where banana wine is scarce and sorghum beer plentiful, and as low as 1 in the East, where banana wine prices reach rock bottom.
<table>
<thead>
<tr>
<th>Geographic Zone</th>
<th>Banana Wine</th>
<th>Sorghum Beer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prod/ Capita</td>
<td>Cons/ Capita</td>
</tr>
<tr>
<td>East</td>
<td>98</td>
<td>45</td>
</tr>
<tr>
<td>Northcentral</td>
<td>69</td>
<td>33</td>
</tr>
<tr>
<td>Southwest</td>
<td>68</td>
<td>33</td>
</tr>
<tr>
<td>Southcentral</td>
<td>45</td>
<td>25</td>
</tr>
<tr>
<td>Northwest</td>
<td>58</td>
<td>51</td>
</tr>
<tr>
<td>Total Rural Exports</td>
<td>169</td>
<td></td>
</tr>
</tbody>
</table>

Source: National Budget and Consumption Survey (ENBC), Ministry of Plan.
<table>
<thead>
<tr>
<th></th>
<th>Nat'l Average</th>
<th>Kigali (Kibungo)</th>
<th>East (Byumba)</th>
<th>C. North (Gisenyi)</th>
<th>N. West (Cyangugu)</th>
<th>S. West (Gikongoro)</th>
<th>C. South (Butare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Banana wine (72 cl.)</td>
<td>30</td>
<td>34</td>
<td>17</td>
<td>30</td>
<td>30</td>
<td>19</td>
<td>44</td>
</tr>
<tr>
<td>2. Sorghum beer (72 cl.)</td>
<td>13</td>
<td>16</td>
<td>15</td>
<td>15</td>
<td>10</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>3. Primus (72 cl.)</td>
<td>84</td>
<td>84</td>
<td>88</td>
<td>83</td>
<td>78</td>
<td>85</td>
<td>87</td>
</tr>
<tr>
<td>4. Whisky (1 shot)</td>
<td>76</td>
<td>69</td>
<td>80</td>
<td>80</td>
<td>70</td>
<td>75</td>
<td>70</td>
</tr>
<tr>
<td>Price Ratios</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Banana wine Sorghum beer</td>
<td>2.4</td>
<td>2.1</td>
<td>1.1</td>
<td>2</td>
<td>3</td>
<td>2.1</td>
<td>4.4</td>
</tr>
<tr>
<td>6. Banana wine Primus</td>
<td>.37</td>
<td>.40</td>
<td>.19</td>
<td>.36</td>
<td>.38</td>
<td>.22</td>
<td>.51</td>
</tr>
<tr>
<td>7. Sorghum beer Primus</td>
<td>.15</td>
<td>.19</td>
<td>.17</td>
<td>.18</td>
<td>.13</td>
<td>.11</td>
<td>.11</td>
</tr>
</tbody>
</table>

Source: Ministere du Plan (1984), pp. 73, 74.
VI. PATTERNS OVER TIME

A. Changes in Home Brewing

Home brewing activity has increased substantially over the past three decades. Between 1956 and 1983, average household production of banana wine plus sorghum beer increased by about 60% (Leurquin 1959, pp.215,217; Table 1). Since independence, increasing urbanization and the spread of the cash economy have raised overall demand for home-brewed beverages as well as the proportion of production produced for sale. Leurquin (1959, p.211) describes the beginnings of cash home brewing on the periphery of urban settlements and markets in the late 1950's. The decline of the Tutsi monarchy and of feudal control over Hutu land allocation released substantial amounts of grazing land from direct Tutsi control, enabling rapid expansion of crop agriculture. Hence, the late 1950's and early 1960's saw extraordinary expansion of areas planted in bananas, expansion on the order of 7% per year and resulting in an approximate doubling of land area devoted to bananas over a 10-year period ending in the late 1960's (Champion 1965, pp.23,24; Delepiere 1975, p.2.). As Figure D indicates, banana production per capita surged during the 1960's, peaking in the late 1960's. Both Champion (1965, pp.24,28) and Delepiere (1970, p.3) attribute the surge in banana planting and production to the rapid emergence of cash home brewing. Although per capita banana production has declined gradually since the late 1960's, levels today remain above those prevailing at the high-water mark of the late 1960's. The 1984 drought undoubtedly exaggerates the magnitude of the recent per capita slide, 1983 being a more normal recent year.

Declining relative profitability may explain the slowdown in banana expansion. The data in Table 15 indicate that the relative profitability of bananas has declined compared to other major crops over the past 15 years. And because bananas cannot be double cropped, while other crops can, the absolute advantage once held by bananas has been challenged in recent years.

Accompanying the rise and subsequent slowdown in banana expansion has been a steady shift from beer banana to cooking banana production. Up until the middle of the 20th century, farmers planted beer bananas almost exclusively. In the early 1960's, farmers held about 95% of all bananas plantations in beer producing varieties (Champion 1965, p.11,19). But over the past 25 years, farmers have increasingly planted cooking bananas; and by 1984 the share of beer bananas had dropped to about 70% of total production (Ministry of Agriculture 1985, pp.284). This trend may indicate an increasing consumer preference for cooking bananas or at least their growing access to urban markets as a result of road improvements (Ministry of Agriculture 1984, p.83).

B. Changes in the Liquor Market

While per capita consumption of both banana wine and sorghum beer has apparently increased substantially over the past 25 years, consumption of Primus has grown much faster. As Table 16 shows, BRALIRWA production of Primus has grown at about 11% per year, while beer banana and sorghum
TRENDS IN SORGHUM AND BANANA

PRODUCTION (kg/capita)

Source: Ministry of Agriculture, Annual Reports. See Appendix Table A.11.
<table>
<thead>
<tr>
<th></th>
<th>1968</th>
<th>1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bananas</td>
<td>30.3</td>
<td>76.6</td>
</tr>
<tr>
<td>b. potatoes</td>
<td>23.1</td>
<td>63.9</td>
</tr>
<tr>
<td>c. sweet potatoes</td>
<td>-</td>
<td>50.2</td>
</tr>
<tr>
<td>d. beans</td>
<td>8.3</td>
<td>25.3</td>
</tr>
<tr>
<td>e. sorghum</td>
<td>6.9</td>
<td>23.2</td>
</tr>
</tbody>
</table>

2. Profitability Relative to Bananas

<table>
<thead>
<tr>
<th></th>
<th>1968</th>
<th>1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bananas</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>b. potatoes*</td>
<td>.76</td>
<td>.83</td>
</tr>
<tr>
<td>c. sweet potatoes*</td>
<td>-</td>
<td>.66</td>
</tr>
<tr>
<td>d. beans*</td>
<td>.27</td>
<td>.33</td>
</tr>
<tr>
<td>e. sorghum*</td>
<td>.23</td>
<td>.30</td>
</tr>
</tbody>
</table>

*Note: Single cropping season only.

<table>
<thead>
<tr>
<th>1. Bananas (tons)</th>
<th>Compound Annual Rate of Growth, 1961-1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. total production</td>
<td>3.4%</td>
</tr>
<tr>
<td>b. beer bananas</td>
<td>1.8%</td>
</tr>
<tr>
<td>2. Sorghum production (tons)</td>
<td>1.9%</td>
</tr>
<tr>
<td>3. Primus (liters)</td>
<td>10.9%</td>
</tr>
</tbody>
</table>

* Note: To avoid bias due to the arbitrary selection of beginning and ending years, trends have been computed by regressing the natural logarithm of each variable on time.

Source: Appendix Tables A.11 and A.12.
production have increased at 1.8% and 1.9% respectively. The growth gap is not as large as these figures suggest, at least in the case of banana wine, because clearly increasing dilution rates have raised banana-to-wine transformaton rates considerably. Studies from the late 1950's and early 1960's measure water-to-banana-juice dilution rates ranging from 17-24%; while todays brewers more commonly dilute with water equal to between 50% and 100% of the volume of pure banana juice fermented (Munyaangizi 1975, p.80; Champion 1965, p.23; Mihailov 1986b, p.39; and field interviews). Given that beer banana and sorghum production have increased much more slowly than population, only these substantially increased dilution rates can explain the apparent 60% increase in per capita consumption of home-brewed beverages over the past 25 years. But even a doubling, or even quadrupling, of dilution rates would not alter the conclusion that Primus sales have grown most rapidly of all alcoholic beverages.

As incomes rise, demand for Primus grows more rapidly than for the home-brewed beverages. The income elasticity of demand for Primus stands at about 3.5, while that for banana wine is 1.0. Sorghum beer consumption rises least as consumer spending power grows, its income elasticity of demand lying at about .5 (Section II.D.). In addition to lying below that of Primus, income elasticities of demand for home brewed beverages may have declined slightly over time. Leurquin (1959, p.313) has estimated the income elasticity of demand for sorghum beer and banana wine together at 1.1 in 1956, above both those for both home-brewed beverages in 1983. This suggests that over the long run, rates of increase in demand for home-brewed banana wine, and especially for sorghum beer, may continue to fall off.

C. Changes in Relative Prices

Relative prices have changed along with market shares. Over the past 20 years, as Figure E indicates, the price differential between Primus and both home brews has tended to diminish. While nominal prices of all three beverages have increased, sorghum beer and banana wine prices have moved upwards somewhat faster than that of Primus.

The price hikes, especially those of banana wine and Primus, seem to move in close unison. And the Primus consumption tax tracks both with a strikingly strong correlation. Whether tax increases drive up banana wine prices by allowing cabaret owners to boost banana wine prices in tandem with tax-driven Primus price increases, or whether tax hikes follow general inflation is unclear. But the strong correlation between banana wine and Primus prices suggests that these two drinks may be in closer competition than Primus and sorghum beer. Although not supported by the cross-price elasticities of the demand estimated in Section II.D., probably because of the insignificant temporal and regional variation in Primus prices, this notion is supported by the high income elasticities of demand for banana wine and Primus. That, together with the parallel price patterns over time, suggests that over the long run Primus and banana wine may be the closest contenders in a growing alcoholic beverage market.
PRICE TRENDS
IN RWANDA'S ALCOHOLIC BEVERAGE MARKET

RELATIVE PRICE TRENDS
IN RWANDA'S ALCOHOLIC BEVERAGE MARKET

Source: Ministry of Plan, Bulletins Statistiques, various issues.
VII. IMPACT OF POLICY

Government fiscal, pricing and tariff policy have a substantial effect on the relative viability of alternative beverage channels. But the interventions operate almost exclusively on the imported and industrially manufactured beverages.

A. Pricing Policy

Home brewers operate in a largely unregulated competitive environment. They buy inputs and sell wine and beer accountable only to the laws of supply and demand. Prices in cabarets and at distribution points appear fiercely competitive and are not subject to government price control legislation. The one exception, government intervention in sorghum markets, is only now being carefully studied (See Loveridge and Ngirumwami, 1987 for preliminary results).

In contrast, government directly sets the ex-factory prices of large-scale domestic manufacturers such as BRALIRWA and OVI BAR. They do so by a process of "homologation" which is based on a review of costs of production and what government considers reasonable profit margins. As Appendix Table A.11 indicates, Primus' homologated price has remained the same since 1983. Because the Ministry of Finance also sets maximum allowable commercial margins at the wholesale and retail level, they effectively set both the ex-factory and the retail price of Primus. While the Ministry's policing powers are limited, Primus prices appear to remain close to the mandated level. Nonetheless, after the coffee harvest, during holidays, and at other times of the year when demand is high, actual prices may exceed legal maxima by 5-25% (Ministry of Mines, Industry and Artisanry 1984, p.20).

Government also sets retail prices for imported hard liquor and other imported alcoholic beverages. As with Primus, the Ministry of Finance invokes standard allowable commercial margins, 15% for manufacturers and wholesalers and 25% for retailers, for merchants distributing imported beverages. These marketing margins combine with import duties to make government the major decision maker in setting selling prices for these beverages.

B. Tariffs

The Government of Rwanda currently makes a strong statement with its tariff policy. It levies a 392% duty on imported beer which, combined with high transport costs to Rwanda, make imported beers prohibitively expensive. As Table 1 indicates, they account for less than .02% of total alcoholic beverage sales. Thus, through its tariff policy, government has granted BRALIRWA a virtual monopoly on beer production.

For imported wines, hard liquors and liqueurs, government sets specific tariffs with ad valorem equivalents of about 125% on average. They deem these levels high enough to raise substantial revenue but not so punitively high as to halt imports altogether.

Through its duties on imported inputs, government has shown a clear, although perhaps unintentional, preference. They exempt BRALIRWA from all
input duties on barley malt, their primary input, but at the same time place a 40% duty on imported enzymes used by OVIBAR to increase banana juice extraction rates. If enzymes prove effective at increasing extraction rates under home brewer conditions, it will be important to remove this levy to encourage enzyme use among home brewers. The potential economic gains to Rwanda are enormous as Section VIII will discuss.

C. Fiscal Policy

Fiscal policy also affects the relative profitability of Rwanda's seven alcoholic beverage channels. The net effect of fiscal policy has been to subsidize OVIBAR and to tax the other channels, although at widely differing rates.

OVIBAR, a state-owned company, has received subsidies annually since its inception. OVIBAR management, in the unenviable position of having to start up a company for which the scaled-up industrial technology was only imperfectly understood, endowed with a physical plant containing several design flaws which have lead to regular equipment failure (Treutens 1986, pp.40-46), and operating under the constraints of government supervision, have not surprisingly required financial subsidies to remain solvent. According to MINIMART, annual subsidies to OVIBAR averaged 22 million FRw per year in its first six years of operation, a period during which annual revenues averaged only 29 million. The situation has improved in recent years. In 1984, the government subsidy had dropped to 8.5 million FRw and sales had risen to 60 million FRw. Government has eliminated the OVIBAR subsidy from its 1987 budget, forcing the company to either achieve profitability or cease operating.

Communes currently levy taxes on home brewers and cabaret owners. They charge a tax on drums of beer sold at distribution centers. Currently, for example, the rate stands at 50 FRw for a 120-liter drum at the Rugende distribution center, the principal banana wine supply point funneling production from the East to Kigali. And tax officials levy the fee only on producers selling 120-liters at a time in order, they say, not to penalize the small, infrequent producers. Communes also levy a monthly tax on cabarets, although the rate charged varies widely. The 1981 cabaret tax ranged from 1,000 FRw per month in Butamwa Commune, Kigali Prefecture to about 80 FRw per month in Ngoma Commune, Butare Prefecture (Ministry of Interior, 1981). As Appendix Tables A.10 indicates, these taxes contribute an average of 3.5% to commune revenues, although the figure rises as high as 15% in urban communes or those housing a major distribution center. These taxes constitute a minor expense item compared to cabaret revenues. As Table A.7 indicates, the cabaret levies currently tax on the order of 1% of monthly cabaret profits.

BRALIRWA and consumers of Primus face a much higher effective tax rate. The Government of Rwanda imposes a special consumption tax on Primus. As Appendix Table A.12 shows, the tax has risen at intervals over the years, and currently it stands at 44 FRw/bottle. This represents 200% of the 22 FRw ex-factory price and over half of the 84 FRw retail price. The tax is easily administered, as it is paid directly by BRALIRWA to the Ministry of Finance. It is also a major source of revenue, accounting for 20% of total central government revenues.
Given the price sensitivity of demand, the tax has clear dampening effects on Primus demand. As the price and sales data in Appendix Table A.12 indicate, sales volume dropped by 11% between 1982 and 1983 as a result of the 11 FRW increase in the consumption tax which drove retail prices from 74 FRW to 84 FRW per bottle. It was not until 1985 that sales recovered to their 1982 level.

D. The Net Impact

The net effect of the tariff duties, consumption, market and cabaret taxes has been measured by the Ministry of Finance in preparing its input-output table for Rwanda. Displayed in Table 17, their figures include all indirect taxes, although they exclude direct personal and corporate income taxes.

The data in Table 17 indicate that government captures about 57% of the total value of retail sales of Primus but only about 0.4% of the sales value of home-brewed beverages. These figures may even understate the relative rates of taxation given that direct income and profits taxes are likely to be more effectively collected from BRALIRWA and its commercial distributors than from home brewers and cabaret owners.

The important effect of this tax structure is to raise the price of Primus above that of banana wine. Were it not for the heavy consumption tax imposed on Primus, that beverage today would retail in Kigali at below the price of banana wine. While Government apparently imposed the Primus tax for purely revenue reasons, in so doing they instituted what is probably their single most important intervention in favor of home brewers.
TABLE 17

FISCAL IMPACT ON RELATIVE BEVERAGE PRICES, RWANDA

(FRw per 72 cl. bottle)

<table>
<thead>
<tr>
<th></th>
<th>Sorghum Beer</th>
<th></th>
<th>Banana Wine</th>
<th></th>
<th>Primus 1982-87</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Retail Price</td>
<td>13 20</td>
<td>31 40</td>
<td></td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>2. Indirect Taxes as Percent of Sales</td>
<td>.4% .4%</td>
<td>.4% .4%</td>
<td>.57%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Indirect Taxes per Bottle</td>
<td>.03 .1</td>
<td>.1 .2</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Retail Price minus Indirect Taxes (1-2)</td>
<td>13 19.9</td>
<td>30.9 39.8</td>
<td>36</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Ministere des Finances et de l'Economie (1985); Ministere du Plan (1987); Ministry of Plan, Statistical Unit.
VIII. CONCLUSIONS AND RECOMMENDATIONS

A. Recommendations

1. Maintain price spread between Primus and home brews.

The most important policy currently in effect in Rwanda's alcoholic beverage subsector is the consumption tax on Primus. It raises Primus' retail price to double that of banana wine, while in a policy neutral environment Primus would retail at a slightly lower price than that most popular home brewed beverage.

Government has sound reasons for promoting home brewing by taxing competitive beverages. Home brewers produce 3.2 full-time jobs per thousand FRw in sales compared to 0.6 for Primus (Table 1 and Figure A). And they generate jobs primarily in rural areas, while the Primus manufacturing and distribution networks remain largely urban. Home-brewed beverages also generate greater income multipliers than does Primus. While 99% of home brew sales support domestic value added, only 80% of Primus sales do given their large share of imported inputs (Ministry of Finance and Economy 1985). On employment, income, income distribution and regional decentralization grounds, home brewed beverages appear worthy of the policy makers' favor.

2. Measure the effect of enzymes on home brewer banana juice extraction rates.

Prospects for raising the efficiency of banana wine brewers hold potentially exceptional economic returns to Rwanda. Potential extraction rates are currently double those achieved by home brewers. If even half of this efficiency gap could be captured, home brewers could raise their extraction rates from approximately 40% to 60%, resulting in a substantial windfall for Rwanda. It would be possible to produce current output of banana wine with two-thirds of the bananas currently used. Brewers, in this case, would have four options: a) they could eat the 458,000 tons of bananas freed up, the equivalent of one-fourth of total (beer plus cooking plus table) banana production, raising national caloric intake by 9%; b) they could pull the surplus beer banana land out of banana production, releasing approximately 5% of currently cultivated land area; c) they could increase banana wine production by 50%; or d) they could maintain current banana wine production levels but produce a higher quality wine by reducing dilution rates (Calculated from Ministry of Agriculture 1985, pp. 28, 284, 289 and Appendix Table A.11). Or they could institute any combination of the above changes. In any of these four cases, Rwanda would be better off - at least in strict economic terms. Improved efficiency in brewing would free up resources and open up economic options.

But Rwanda will achieve none of these potential economic gains unless home brewers find it profitable to use enzymes. Home brewer adoption of enzymes depends on the potential yield increase relative to the cost of enzymes. It also depends crucially on whether or not enzymes alter the taste of the banana wine produced. Only field testing can determine what efficiency gains can be realized under home brewer conditions and whether or not consumers will notice taste differences with the new procedures.
In the interim, it is possible to determine what rate of increase in extraction rates will be necessary to make home brewer adoption of enzymes viable. Showing rates of return under a range of hypothetical increases in extraction rates, Table 18 suggests that 12% is the breakeven point. That is, any increase in yield above 12% will raise home brewer profits. So if home brewers currently extract 40% of banana weight as juice, enzymes will need to boost that rate to 45% to be profitable. A 20% increase, to 48%, will yield a 50% return over additional enzyme and associated costs. These achievements appear well within attainable levels. Moreover, the 12% breakeven point is estimated based on very conservative assumptions. It prices enzymes inclusive of the current 40% tariff and uses what are probably excessively high packaging and distribution margins. If enzymes enter Rwanda duty free, the breakeven point for home brewer adoption will drop to a 9% increase in extraction rates.

A network capable of importing, packaging and delivering enzymes to home brewer distribution centers should not be difficult to establish. Table 19 suggests that commercial enzyme distribution, either by OVIBAR or by private firms or agencies, could be viable. While OVIBAR could most quickly jump into enzyme packaging and resale, providing technical assistance as well, distribution should not be limited to them. Home brewers will be best served if many firms import enzymes and compete to supply them at lowest cost.

3. If the enzymes enzyme use is profitable for home brewers, government should quickly intervene, raising communal taxes on cabarets and drums of banana wine.

Such a tax increase would accomplish two goals: a) it would augment scanty communal financial resources, and b) widen the gap between producer and consumer prices for banana wine. The second objective will be essential in order to avoid a worst-case scenario in which technical innovation permits a large increase in banana wine production which in turn causes banana wine prices to plummet inducing excessive consumption, drunkenness and disorderly conduct. While economic theory suggests that consumers will be better off in such a case, doing more of what they enjoy, such a result is unlikely to be in the best interest of Rwanda. Banana wine exhibits few nutritional virtues: it deprives consumers of 60% of the calories available in bananas, and it raises alcohol consumption. And the resources freed up through improved brewer efficiency could be used much more effectively, particularly if they resulted in increased banana consumption or the release of scarce land for other purposes.

Controlling what happens - even predicting with precision the results of a large increase in brewer productivity - becomes rapidly very complex. Since some increase in banana wine production is probably inevitable, at least in the short run following such an intervention, the initial result will likely be to lower the price of banana wine through an outward shift in the supply curve. Consumption will increase. Purchasers will be able to buy more wine at lower prices, and the cost of own-consumption will also drop, raising the volume of autoconsumption of banana wine.

After the initial price drop and consumption increase, predition becomes difficult. The second round effects depend on a set of complex
### TABLE 18
ECONOMIC PROFITABILITY OF HOME BREWER ADOPTION OF ENZYMES TO INCREASE BANANA JUICE EXTRACTION RATES, RWANDA 1987

<table>
<thead>
<tr>
<th>Status Quo</th>
<th>10%</th>
<th>12.4%</th>
<th>20%</th>
<th>50%</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>(standard batch of 4, 20-liter jerry cans)</td>
<td>2,800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Revenue
   4 jerry cans @ 700 FRw | 280 | 347 | 560 | 1,400 | 1,680 |

2. Costs
   a. bananas
      273 kg. @ 8 FRw/kg. = | 2,182 | 0 | 0 | 0 | 0 |
   b. sorghum plus milling
      9 kg. @ 23 FRw/kg. = | 209 | 21 | 26 | 42 | 105 | 125 |
   c. labor
      1.8 p. days @ 50 FRw = | 90 | 0 | 0 | 0 | 0 |
   d. transport to distribution center
      4 jerrycans @ 40 FRw = | 160 | 16 | 20 | 32 | 80 | 96 |
   e. enzymes
      .07 kg. packet = | 0 | 300 | 300 | 300 | 300 | 300 |
   Total cost | 2,641 | 337 | 346 | 374 | 485 | 521 |

3. Increased Revenue
   Increased Costs
   - .8 | 1.0 | 1.5 | 2.9 | 3.2 |

* If a brewer currently extracts 40% juice/kg of banana, a 10% increase involves raising the extraction rate to 44%.

Source: Field interviews, Appendix tables A.4 and A.5
TABLE 19

POTENTIAL OVIBAR REVENUE FROM PACKAGING AND SELLING ENZYMES TO HOME BREWERS OF BANANA WINE

1. Ovibar cost of .07 kg of enzymes required for production of four jerrycans @ 2,761 FRw/kg = 196 FRw for four jerrycans (including current 40% import duty on enzymes)

2. Estimated packaging costs plus wholesaler margin = 54 FRw

3. Sell either:
   - to distributors @ 196 + 54 = 250 FRw per .07 kg packet, or
   - directly to home brewers @ 250 FRw + distribution costs and retailing margin of about 50 FRw = 300 FRw cost to home brewers

4. If 10% of home brewers of banana wine adopt enzymes, total sales of enzymes = 360,000,000 liters of wine x 10%
   = 36,000,000 liters of production with enzymes
   = 1,800,000 jerry cans
   = 450,000 standard 4-jerry can batches requiring .07 kg each

5. Revenue accruing to Ovibar or any other importer of enzymes
   = 450,000 enzyme packets @ 250 FRw each
   = 112,500,000 FRw in wholesaler revenues

6. Gross margin earned by Ovibar or other importers
   = 450,000 @ 54 FRw
   = 24,300,000 FRw

Compare with Ovibar's total 1986 sales revenue of 54,300,000.

Source: Enzyme cost and utilization rate calculated from Ovibar (1986); home brewer volumes from Table 1.
interactions, because an initial drop in banana wine prices will affect all relative prices in the economy. The subsequent supply response of home brewers will depend on the options available to them.

As these events unfold, the basic aim of policy intervention must be to drive a wedge between producer and consumer prices of banana wine. By raising home brewing taxes, government dampens the decline in consumer prices, thus diminishing the banana wine consumption surge and minimizing the nutritional and social liabilities incumbent in such an increase. At the same time, the increased tax diminishes prices received by producers. This reduces the profitability of banana wine production and makes alternative investments more attractive. Such action makes it more attractive for home brewers to diminish the land area devoted to beer bananas, either releasing land to other crops or, if the food security properties of bananas restrain farmers from taking this step, it at least motivates farmers to substitute cooking bananas for beer bananas. This would accelerate a 20-year trend in that direction, representing a significant step forward in efforts at achieving food security (Ministry of Plan 1984, p.19).

Implementation of a home brewing tax on the heels of a successful introduction of enzyme use among home brewers will require careful monitoring. Legislation should consider granting authority for tax rate adjustment within a certain allowable range. Such a procedure has recently been legislated for setting import tariffs and, if adopted, would provide authorities with important latitude to adjust the tax rate in response to observed changes in the beverage market. A careful monitoring of cabaret prices and perhaps vehicle counts at key distribution centers would provide low-cost information necessary in fine tuning the home brewing tax rate.

Successful administration of increased home brewer taxes also requires effective collection by the communes. The data in Table 20 indicate that current collection rates vary considerably among localities, averaging about 50% of the total beverage tax liability. While many localities apparently operate effective collection systems, others may require support in gearing up for increased assessments.

Policy makers should also consider coordinating efforts with Ministry of Agriculture extension staff. As the profitability of banana wine production declines, farmers may be especially attuned to suggestions for alternative income-earning opportunities. Perhaps thinning beer banana plantations through intercropping would prove more palatable than razing banana fields to begin monocropping of an alternative crop. At the very least, extension personnel could help facilitate a shift from beer bananas to cooking and table bananas, a strategy which would maintain all the food security advantages of bananas while at the same time producing substantial nutritional gains.

4. Earmark a portion of the home brewing tax to support technical research on banana wine and sorghum beer production.

The third advantage of introducing a home brewing tax is that it would provide revenue, a portion of which could be earmarked for technical research on both banana wine and sorghum beer production. OVIABAR is the
TABLE 20

APPARENT COMMUNE COLLECTION RATES
OF CABARET TAXES,
RWANDA 1981

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>1. Budget Estimates of Cabaret Numbers*</th>
<th>2. Number Taxed (cabaret revenues/rate per cabaret)</th>
<th>3. Apparent Collection Rate (2/1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kigali</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Butamwa</td>
<td>49</td>
<td>35</td>
<td>71%</td>
</tr>
<tr>
<td>2. Butare</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Mugusa</td>
<td>50</td>
<td>15</td>
<td>30%</td>
</tr>
<tr>
<td>b. Ngoma</td>
<td>60</td>
<td>29</td>
<td>48%</td>
</tr>
<tr>
<td>c. Ntyazo</td>
<td>10</td>
<td>1</td>
<td>10%</td>
</tr>
<tr>
<td>d. Runyinya</td>
<td>75</td>
<td>45</td>
<td>60%</td>
</tr>
<tr>
<td>3. Kibungo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Muhazi</td>
<td>86</td>
<td>77</td>
<td>90%</td>
</tr>
</tbody>
</table>

* These are estimates made by communes in their budget projections of cabaret revenues.

most likely home for such research, although it need not be confined there. Applied technical research will be essential if Rwanda really wishes to increase utilization of products based on bananas.

Currently only OVIBAR does research on banana wine biochemistry and microbiology. And they have been in the impossible position of having to finance that research out of profits from a commercial operation founded on a process that technical research has not yet mastered. Banana wine, unlike all other industrial production in Rwanda, is not produced in industrial countries. No on-the-shelf technology is available which can be easily imported to solve production problems at OVIBAR. The most closely analogous situation in recent memory is that of the sorghum beer industry in Southern Africa. There too, factory brewers tried to enter an indigenous market dominated by home brewers. But the scaling up of microbiological processes causes countless unforeseen problems with heat generation, spoilage, temperature control, unevenness, consistency, input procurement, marketing and distribution. Because sorghum beer is not produced elsewhere in the world, the microbiology of sorghum beer production had never been studied. So early factory brewers endeavored to learn about the brewing technology as they went. They fumbled for decades before the South African government finally realized that the industry would never prosper until they had mastered the biochemistry and microbiology of production. So, in 1953, they introduced a 1 cent per liter tax on sorghum beer sales earmarking for support of technical research on sorghum beer. They established a Sorghum Beer Unit which, even insulated from fundraising obligations, required about 10 years to master the brewing technology. Following the Sorghum Beer Unit's identification of optimal malting and brewing techniques, the factory brewing industry mushroomed. Research efforts with secure funding and staff insulated from day-to-day market pressures and management problems will be necessary if Rwanda is to develop improved banana processing technology.

Research work may not require setting up a new institution or laboratory. It may be sufficient to generate funds that will support work at existing institutions. OVIBAR, BRALIRWA or even private food processing firms could bid for research contracts. The funds could also be used to finance extension work, for example field trials with enzymes or other promising technologies.

Research and field testing will be required for both banana wine and sorghum beer. Unlike past work, future research should focus on improving performance and profitability of home brewers, by far the largest source of production, employment and income in the subsector.

5. Eliminate the tariff on enzymes.

Currently importers of enzymes pay a tariff of 40%, while BRALIRWA imports its major inputs duty free. If pectinic enzymes prove viable for home brewers, government will want to make them available as cheaply as possible to encourage maximum use.

6. Test malting properties of sorghum.

Similar potential exists to improve efficiency of sorghum beer brewers. But to determine its magnitude will require more preliminary work than is
necessary with banana wine. Enzymes are available today in Rwanda, at OVI BAR, and they can be distributed for home brewing trials without delay. Improved sorghum malt, trade malt, is not available in Rwanda.

As a first step, technicians in Rwanda must obtain the substantial technical literature available on sorghum malting. Next, some simple lab work will be required, following internationally standardized procedures, to test the diastatic power of home-made malt currently in use. Third, a laboratory should run malting trials with all different sorghum varieties currently grown in Rwanda to identify those with the best malting properties. They can then compare germination rates and diastatic potential of domestic varieties with those of varieties available elsewhere in Africa. While it will far easier to introduce trade malting based on existing varieties, it may be possible - as Technoserve and others are currently trying with sunflowers - to initiate field trials with new, imported sorghum varieties.

As the experiments advance, technical staff should enter into discussions with large producers of malt. Most helpful would be maltsters who also brew sorghum beer on a regular basis. This would allow immediate feedback on the effectiveness of alternative malting procedures. In addition, regular maltsters will be potential candidates for setting up trade malting operations if the technical parameters can be identified.

7. Field test improved malt with home brewers.

Improved malt may come from a Rwandan test laboratory, from supervised home maltsters, or it may be imported from elsewhere in Africa. As with the banana wine enzymes, trade malt should be distributed to a half dozen or so carefully selected brewers to find their reaction and to see how much their material inputs can be reduced.

To introduce the trade malt successfully, it may be necessary to explore further the microbiology of Rwandan sorghum beer production. Starting from results published by the Sorghum Beer Unit, technicians can identify key microbial cultures and the optimal conditions in which the desirable organisms multiply and undesirable ones do not.

B. Conclusions

In sum, Rwanda's alcoholic beverage subsector is dominated by home brewers of banana wine and sorghum beer. Technical evidence suggests that it may be possible to enhance their already impressive economic contributions - to employment, income and geographic decentralization - by increasing home brewer technical efficiency. By using pectic enzymes in banana wine production and trade malt in the brewing of sorghum beer, home brewers may be able to close the considerable efficiency gap that currently separates them from technical optima. To determine what portion of the efficiency gap can actually be closed will require field trials under home brewer conditions. In view of the considerable potential for freeing up scarce resources - especially land - through improved brewing efficiency, high priority should be given to undertaking these field trials.


### APPENDIX TABLE A.1

**PROFITABILITY OF ALTERNATIVE FOOD CROPS**  
**RWANDA 1984**

<table>
<thead>
<tr>
<th>Crops</th>
<th>Gross Returns to Land</th>
<th>Gross Returns to Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bananas (per year)</td>
<td>1,086</td>
<td>76,000</td>
</tr>
<tr>
<td>2. Manioc (per season)</td>
<td>520</td>
<td>90,900</td>
</tr>
<tr>
<td>3. Potatoes (per season)</td>
<td>376</td>
<td>63,900</td>
</tr>
<tr>
<td>4. Sweet potatoes (per season)</td>
<td>314</td>
<td>50,200</td>
</tr>
<tr>
<td>5. Beans (per season)</td>
<td>168</td>
<td>25,300</td>
</tr>
<tr>
<td>6. Sorghum (per season)</td>
<td>166</td>
<td>23,200</td>
</tr>
<tr>
<td>7. Maize (per season)</td>
<td>151</td>
<td>20,400</td>
</tr>
<tr>
<td>8. Peanuts (per season)</td>
<td>130</td>
<td>22,100</td>
</tr>
<tr>
<td>9. Peas (per season)</td>
<td>110</td>
<td>19,900</td>
</tr>
<tr>
<td>10. Eleusine (per season)</td>
<td>108</td>
<td>11,900</td>
</tr>
<tr>
<td>11. Yams (per season)</td>
<td>-</td>
<td>105,400</td>
</tr>
<tr>
<td>12. Rice (per season)</td>
<td>-</td>
<td>73,900</td>
</tr>
<tr>
<td>13. Colecase (per season)</td>
<td>-</td>
<td>70,000</td>
</tr>
<tr>
<td>14. Soya (per season)</td>
<td>-</td>
<td>31,000</td>
</tr>
<tr>
<td>15. Wheat (per season)</td>
<td>-</td>
<td>20,900</td>
</tr>
</tbody>
</table>

APPENDIX TABLE A.2

BANANA WINE,
AN INVENTORY OF ESTIMATED TECHNICAL COEFFICIENTS

A. Banana Wine

1. Fruit (pulp) as percent of bunch (regime) weight
   a. Champion (1963), p.31  
   b. Ovibar (1986), p.64  
   d. Munyanganzini (1975), p.47  
   e. GRET (1976) Rwanda, Burkina and Benin 56 - 65%

2. Juice extraction as percent of fruit (pulp) weight
   a. Laboratory experiments  
      (Munyanganzini, 1976 pp.46,69,81)
      1) - mechanical pressure only (300 kg/cm2) 0%  
         - heat (autoclave 10 minutes 1 kg pressure) + 300 kg/cm2 pressure 40%

   2) chemicals (CaO)
      | CaO | Pressure in kg/cm2 |
      | Concentration | 10 | 20 | 40 | 80 | 200 | 300 |
      | .25% | 53% | | 70% | 76% | 82.5% | 85.5% |
      | .5%  | 58.5% | | 72.5% | 77.5% | 83% | 85.5% |
      | 1.0% | 59% | | 71.5% | 77% | 82.5% | 86% |

   3) enzymes
      | Pressure in kg/cm2 |
      | Temperature | 10 | 20 | 40 | 80 | 200 | 300 |
      | 30 C. | 55.5% | 65.5% | 75% | 80% | 85.5% | 87.2% |
      | 40 C. | 61.5% | 70.2% | 75.7% | 81% | 85.5% | 88.2% |
      | 50 C. | 64.3% | 72.5% | 77% | 82% | 86.5% | 88.7% |

   b. Ovibar
      - per interview, 7/87  
      - per Haendler (1981)  
      - per Ovibar (1986)  
      71-85%  
      75%  
      60-71%

   c. Home brewers
      - Munyanganzini (1975), pp.80,81,84  
      - calculation from Mihailov (1986b), p.27  
      - GRET (1976)  
      - field interview, large-scale producer  
      48-53%  
      44.5%  
      48-54%  
      29%
3. **Dilution Rates**

<table>
<thead>
<tr>
<th>liters of water</th>
<th>liters of pure banana juice</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

a. **Ovibar**

b. **Home brewers**
   - Mihailov (1986b), pp. 27, 39
   - field interview 1987, large-scale producer
   - Munyangazi (1975), p. 80
   - Champion (1965), p. 23

<table>
<thead>
<tr>
<th>Source</th>
<th>Dilution Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mihailov (1986b)</td>
<td>1.0</td>
</tr>
<tr>
<td>field interview 1987</td>
<td>1.0</td>
</tr>
<tr>
<td>Munyangazi (1975)</td>
<td>0.6</td>
</tr>
<tr>
<td>Champion (1965)</td>
<td>0.14 - 0.27</td>
</tr>
</tbody>
</table>

4. **Aggregate Transformation Rate**

   (1. Fruit as % of bunch weight)
   x (2. Juice extraction rate)
   x (3. Dilution rate)

<table>
<thead>
<tr>
<th>Source</th>
<th>Dilution Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIPLAN (1986), p. 11</td>
<td>0.33</td>
</tr>
<tr>
<td>MINIPLAN (1984), p. 57</td>
<td>0.32</td>
</tr>
<tr>
<td>MINAGRI per MINIMART (1984), p. 49</td>
<td>0.28</td>
</tr>
<tr>
<td>Christa Desert, personal communication based on field interviews near Rubona</td>
<td>0.37</td>
</tr>
<tr>
<td>field interview 1987, large-scale producer</td>
<td>0.29</td>
</tr>
<tr>
<td>Mihailov (1986b), p. 27</td>
<td>0.50</td>
</tr>
<tr>
<td>GRET (1976)</td>
<td>0.42</td>
</tr>
<tr>
<td>Champion (1965), p. 22</td>
<td>0.50</td>
</tr>
<tr>
<td>-- Butare and Cyangugu</td>
<td>0.57</td>
</tr>
<tr>
<td>-- Gisenyi</td>
<td>0.28 - 0.33</td>
</tr>
<tr>
<td>-- center of Rwanda</td>
<td>0.36</td>
</tr>
<tr>
<td>implicit ENBC/SESA estimate</td>
<td>0.30</td>
</tr>
<tr>
<td>-- ENBC estimates 360 million liters b. wine</td>
<td></td>
</tr>
<tr>
<td>-- SESA beer banana production estimate 1,374,762 tons</td>
<td></td>
</tr>
<tr>
<td>-- 360,000,000 liters/1,374,762 tons bananas</td>
<td>0.26</td>
</tr>
</tbody>
</table>
APPENDIX TABLE A.3

SORGHUM BEER,
AN INVENTORY OF ESTIMATED TECHNICAL COEFFICIENTS

1. Conversion rates

<table>
<thead>
<tr>
<th>Source</th>
<th>liters of beer/kg. sorghum</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIPLAN (1984), p.57</td>
<td>3.6</td>
</tr>
<tr>
<td>MINIPLAN (1984), p.59</td>
<td>4.0</td>
</tr>
<tr>
<td>Mihailov (1986a), p.24</td>
<td>5.0</td>
</tr>
<tr>
<td>Mihailov (1986b), p.40</td>
<td>3.0</td>
</tr>
<tr>
<td>MINAGRI per MINIMART (1984), p.49</td>
<td>1.63</td>
</tr>
<tr>
<td>field interviews, 1987</td>
<td></td>
</tr>
<tr>
<td>- producer 1</td>
<td>2.0</td>
</tr>
<tr>
<td>- producer 2</td>
<td>2.3</td>
</tr>
<tr>
<td>- producer 3</td>
<td>2.8</td>
</tr>
<tr>
<td>- producer 4</td>
<td>4.0</td>
</tr>
</tbody>
</table>

2. Proportion of sorghum crop used to produce sorghum beer

a. published data

<table>
<thead>
<tr>
<th>Source</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIPLAN (1984), p.38</td>
<td>90%</td>
</tr>
<tr>
<td>MINIPLAN (1986), p.12</td>
<td>79%</td>
</tr>
<tr>
<td>Mihailov (1986a), p.24</td>
<td>25%</td>
</tr>
<tr>
<td>calculated from Mihailov (1986b), p.40</td>
<td>42%</td>
</tr>
</tbody>
</table>

b. implicit in ENBC data

- ENBC production estimate 204,430,000 liters sorghum beer in 1983
- MINAGRI (1986) estimate of 1983 sorghum production = 188,537 tons

If conversion rate is 4 liters beer/kg. sorghum, then proportion of sorghum crop converted to sorghum beer = 204,430,000/(4*188,537,000) = .27

If conversion rate is 2 l/kg, then proportion sorghum brewed is .54
If conversion rate is 3 l/kg, then proportion sorghum brewed is .36
If conversion rate is 4 l/kg, then proportion sorghum brewed is .27
APPENDIX TABLE A.4

PROBABLE ENZYME COSTS FOR HOME BREWERS

1. Ovibar Enzyme Use, 1986
   a. quantity of bananas processed = 1,100 tons
   b. quantity of enzymes used = 285 kg
   c. 285 kg enzymes/1,100 tons bananas = .26 kg enzymes/ton bananas
   d. price of enzymes = 2,781 FRw/kg
   e. .26 kg x 2,871 = 721 FRw of enzymes per ton of bananas processed

2. Probable Home Brewer Requirements
   a. 1.5 tons bananas yields 22 (20 liter) jerry cans banana wine, i.e. 1 jerry can requires 68 kg bananas
   b. .26 kg enzymes/ton bananas x 1.5 tons bananas
      = .39 kg enzymes/22 jerry cans @ 2,871 FRw/kg
      = 1,080 FRw enzymes/22 jerry cans
      = 49 FRw/jerry can
   c. assume packaging and distribution raise enzyme cost by 50%, to 75 FRw/ jerry can.
   d. Since common home brewed batch of banana wine for sale = 4 jerry cans, probable cash outlay per brew is about 75 FRw x 4 = 300 FRw/batch.

Source: Ovibar (1986), pp.28,29,68; home brewer interviews; Table 23.
APPENDIX TABLE A.5

SAMPLE BUDGET FOR BANANA WINE PRODUCTION

1. Large Scale Producer
   (22 jerry can batch 2 to 3 times per week)

   Revenue
   22 jerry cans (20 liters each)
   @ 700 FRw each = 15,400 FRw

   Costs
   - bananas
     1.5 tons @ 8 FRw/kg = 12,000
   - sorghum
     50 kg plus milling @ 23 FRw/kg = 1,150
   - labor
     4 person days @ 100 FRw/day = 400
   - transport to distribution center
     @ 40 FRw per jerrycan = 880
   - Total 14,430

   Economic Profit 970 FRw/22 jerrycans

2. Small producers

   Revenue
   4 jerrycans @ 700 FRw/jerrycan = 2,800

   Costs
   - bananas
     273 kg @ 8 FRw/kg = 2,182
   - sorghum
     9.1 kg plus milling @ 23 FRw/kg = 209
   - labor
     1.8 p.days @ 50 = 90
   - transport to distribution center
     @ 40 FRw/jerrycan = 160
   - Total 2,641

   Economic Profit 159 FRw/4 jerrycans

Source: Field interviews.
APPENDIX TABLE A.6

SAMPLE BUDGET FOR SORGHUM BEER PRODUCTION

1. Large Scale Brewer
   (160 liters 2 to 3 times per week)

   Revenue
   8 jerry cans (160 liters) @ 300 FRw ea. = 2,400 FRw

   Costs
   - sorghum, 58 kg @ 27 FRw (grain plus milling) = 1,566
   - labor, 2 person days @ 100 FRw = 200
   - firewood, 2 bales @ 90 FRw ea. = 180
   - transport to market @ 40 FRw/jerry can = 320
     Total 2,266

   Economic profit 134 FRw/8 jerrycans

2. Four Jerry Can Batch
   (80 liters)

   Revenue
   4 jerry cans @ 300 FRw ea. = 1,200

   Costs
   - sorghum, 29 kg @ 27 FRw = 783
   - labor, 1 day @ 100 FRw = 100
   - firewood, 1 bale @ 90 FRw = 90
   - transport to distribution center @ 40 FRw/jerry can = 160
     Total 1,133

   Economic Profit 67 FRw/4 jerrycans

Source: Field interviews.
APPENDIX TABLE A.7

SAMPLE BANANA WINE CABARET BUDGET,
KIGALI 1987

Revenue

4,200 bottles/month* @ 40 FRw/bottle = 168,000 FRw per month

Costs

- purchase banana wine @ 700 FRw/jerry can (= 27 FRw/bottle) + 3 FRw/bottle transport from distribution center to cabaret = 30 FRw/bottle total cost = 126,000
- labor, 2 @ 100 FRw/day = 2 FRw/bottle = 6,000
- rent and furnishings = 5,000
- bad debts @ 5% = 8,400
- cabaret tax** = 210

Total costs = 145,610

Monthly Profit = 22,390 FRw/month

* Monthly volume estimated at 100 liters per day x 30 days = 3,000 liters per month = 3,000/.72 = 4,200 72 cl. bottles per month

**Cabaret tax estimated at national average per Ministry of Interior (1981). Computed as 40 million FRw total revenues/584 million liters of total banana wine and sorghum beer sales = .07 FRw/liter = .05 FRw/bottle.

Source: Field interviews; Ministry of Interior (1981).
APPENDIX TABLE A.8

ALTERNATIVE ESTIMATES OF HOME BREWING EMPLOYMENT

1. Estimated Sorghum Beer Employment
   (based on field interviews)
   - total volume produced = 204 million liters (Table 1)
   - labor requirements = 2 days/160 liters brewing
     1 day/160 liters malting
     3 days total labor per 160 liters
     = 1.9 person-days per 100 liters
   - for rural exports, time required to get brew to distribution point,
     sell and return; estimate for 4 jerry cans
     2 hours transport to distribution point
     2 hours selling time
     2 hours transport back
     6 hours total per 80 liters
     = 7.5 hrs/100 liters = .94 person days/100 liters
   - Since 204.4 million liters production (Table 1)
     181.8 million liters rural consumption (MINIPLAN, ENBC)
     22.6 million liters = rural exports
     22.6/204.4 = 11% of production exported
   - 11% of .94 = .10 person-days per 100 liters produced
   - total labor requirements for sorghum beer production plus distribution
     = 1.9 + .1 = 2.0 person-days per 100 liters
     = 2 p.days/100 liters x 204.4 million liters
     = 16,352 full-time equivalents for annual sorghum beer production

2. Estimated Banana Wine Employment
   a. minimum, based on field interview of high volume producer
      (production of about 1,320 liters per week)
      - volume = 360 million liters (Table 1)
      - labor requirements = 4 person-days per 440 liters
        = .91 person days per 100 liters
- .91 p.days/100 liters x 360 million liters/250 p.days/p.year
  = 12,960 full-time equivalents production labor

- distribution labor as for sorghum beer, .94 p.days per 100 liters x
  169 million liters rural exports (Table 14)/360 m.liters prodn
  = .44 person days per 100 liters production

- .91 p.days production labor
  + .44 p.days distribution labor
  = 1.35 total p.days per 100 liters

- 1.35 p.days/100 liters x 360 m.l./250 p.days/p.year
  = 19,440 full time equivalents production plus distribution labor

b. **best guess average**
(modification of Treutens, 1986 based on field interviews)

<table>
<thead>
<tr>
<th></th>
<th>Treutens estimate</th>
<th>best guess modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>dig pit</td>
<td>16 h.</td>
<td>1 h. (use old hole)</td>
</tr>
<tr>
<td>unearth regimes</td>
<td>.5</td>
<td>.5</td>
</tr>
<tr>
<td>peel bananas</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>mixing</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>filtering</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>total</td>
<td>30.5 hrs/30 l.</td>
<td>5.5 hrs/30 l.</td>
</tr>
</tbody>
</table>

- 5.5 hours/30 liters = 18 hours/100 liters = 2.3 p.days/100 liters

- 2.3 p.days production
  + .44 p.days distribution
  = 2.77 p.days total labor

- 2.74 p.days/100 liters x 360 m.l./250 p.days/p.year
  = 39,456 full time equivalents production plus distribution labor

per annual banana wine production

3. **Best Guess Estimate of Total Home Brewing Employment**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>sorghum beer</td>
<td>16,352</td>
</tr>
<tr>
<td>banana wine</td>
<td>39,456</td>
</tr>
<tr>
<td>total FTE</td>
<td>55,808</td>
</tr>
</tbody>
</table>
4. Cross-check with Labor Time Allocation Study  
(Ministry of Agriculture, 1978)  

a. estimate based on labor shares  
(p.96) 416 family work hours on home brewing  
30,269 total hours (7 members, 12 hour days)  

\[
\frac{416}{30,269} = \frac{.01358}{1} \text{ of total family work time} 
\]

x 1.5 = .0204 of family work time expressed in 8 hour days  

- 1983 rural population = 5,126,394  
- labor force participation rate = .76 (1978 census)  
- \[5,126,394 \times .76 \times .0204 = 79,480\] full time equivalents per total annual home brewing production  

b. estimate based on labor hours per person  
- 416 hours/6.9 person household spent on home brewing  
- 416 hours x 5 person average hh/6.9 = 301 hours/5 person hh.  
- \[301 \text{ hrs/hh/yr} \times 1,100,000 \text{ rural hh} \times \frac{1}{2,000} \text{ hrs/p.year}\]  

= 165,797 full time equivalents per total annual home brewing production
APPENDIX TABLE A.9

BREAKDOWN OF VALUE ADDED BY BEVERAGE

<table>
<thead>
<tr>
<th></th>
<th>Home-brewed Banana Wine and Sorghum Beer</th>
<th>Primus</th>
<th>Hard Liquor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Imported inputs</td>
<td>1.5%</td>
<td>20%</td>
<td>31%</td>
</tr>
<tr>
<td>2. Value added</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- private</td>
<td>98.0%</td>
<td>22.7%</td>
<td>28%</td>
</tr>
<tr>
<td>- indirect taxes</td>
<td>0.5%</td>
<td>57.3%</td>
<td>41%</td>
</tr>
<tr>
<td>Total v.a.</td>
<td>98.5%</td>
<td>80.0%</td>
<td>69%</td>
</tr>
<tr>
<td>3. Retail price</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

APPENDIX TABLE A.10

IMPORTANCE OF INDIGENOUS BEER TAXES IN COMMUNE FINANCES,
RWANDA 1981

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Revenue from Taxes on &quot;Cruches de Biere&quot; and Cabarets</th>
<th>Total Commune Revenue</th>
<th>1/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Kigali</td>
<td>7,897,600</td>
<td>201,200,000</td>
<td>3.9%</td>
</tr>
<tr>
<td>2. Gitarama</td>
<td>4,706,000</td>
<td>159,652,900</td>
<td>2.9%</td>
</tr>
<tr>
<td>3. Butare</td>
<td>3,728,300</td>
<td>143,859,700</td>
<td>2.6%</td>
</tr>
<tr>
<td>4. Gikongoro</td>
<td>2,207,800</td>
<td>75,398,100</td>
<td>2.9%</td>
</tr>
<tr>
<td>5. Cyangugu</td>
<td>3,567,600</td>
<td>78,808,400</td>
<td>4.5%</td>
</tr>
<tr>
<td>6. Kibuye</td>
<td>1,459,000</td>
<td>74,464,300</td>
<td>2.0%</td>
</tr>
<tr>
<td>7. Gisenyi</td>
<td>2,177,600</td>
<td>78,265,700</td>
<td>2.8%</td>
</tr>
<tr>
<td>8. Ruhengeri</td>
<td>4,276,800</td>
<td>105,001,400</td>
<td>4.1%</td>
</tr>
<tr>
<td>9. Byumba</td>
<td>5,924,700</td>
<td>126,708,600</td>
<td>4.7%</td>
</tr>
<tr>
<td>10. Kibungo</td>
<td>4,435,100</td>
<td>96,370,500</td>
<td>4.6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40,380,500</strong></td>
<td><strong>1,139,729,600</strong></td>
<td><strong>3.5%</strong></td>
</tr>
</tbody>
</table>

High commune 15%
Low commune 1%

### APPENDIX TABLE A.11

**TRENDS IN SORGHUM AND BANANA PRODUCTION**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Area Planted</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. bananas (000 ha)</td>
<td>77.8</td>
<td>99.0</td>
<td>147.0</td>
<td>97.9</td>
<td>94.3</td>
<td>100.2</td>
<td>121.0</td>
<td>130.0</td>
<td>134.5</td>
<td>136.5</td>
<td>150.1</td>
<td>152.7</td>
<td>152.8</td>
</tr>
<tr>
<td>b. bananas (% food crop area)</td>
<td>21.7%</td>
<td>17.9%</td>
<td>20.3%</td>
<td>20.3%</td>
<td>20.1%</td>
<td>20.0%</td>
<td>20.5%</td>
<td>20.6%</td>
<td>20.6%</td>
<td>21.4%</td>
<td>21.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. sorghum (000 ha)</td>
<td>67.0</td>
<td>112.0</td>
<td>86.9</td>
<td>97.6</td>
<td>93.7</td>
<td>130.0</td>
<td>132.0</td>
<td>129.0</td>
<td>125.0</td>
<td>141.0</td>
<td>127.7</td>
<td>131.0</td>
<td></td>
</tr>
<tr>
<td>d. sorghum (% food crop area)</td>
<td>14.7%</td>
<td>17.7%</td>
<td>21.0%</td>
<td>19.0%</td>
<td>21.6%</td>
<td>20.3%</td>
<td>19.7%</td>
<td>19.0%</td>
<td>19.7%</td>
<td>17.9%</td>
<td>16.7%</td>
<td></td>
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<td>c. bananas (% food crops)</td>
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<td>a. bananas (million FRw)</td>
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<td>28.9%</td>
<td>31.2%</td>
<td>37.4%</td>
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<td>c. sorghum (million FRw)</td>
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<td>798.6</td>
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<td>2.92</td>
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*Source: Ministry of Agriculture, Annual Reports, various years.*
## APPENDIX TABLE A.11 (cont.)

TRENDS IN SORGHUM AND BANANA PRODUCTION

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<td>a. bananas (000 ha)</td>
<td>155.1</td>
<td>181.1</td>
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<td>200.3</td>
<td>208.2</td>
<td>212.1</td>
<td>198.1</td>
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<td>21.7%</td>
<td>22.7%</td>
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<td>22.0%</td>
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<td>23.2%</td>
<td>22.3%</td>
<td>22.3%</td>
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<td>c. sorghum (000 ha)</td>
<td>131.1</td>
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<td>147.4</td>
<td>144.6</td>
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<td>a. bananas (000 tons)</td>
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<td>2,362.5</td>
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<td>b. beer bananas as % total</td>
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<td>50.7%</td>
<td>49.7%</td>
<td>50.0%</td>
<td>46.5%</td>
<td>47.9%</td>
<td>49.2%</td>
<td>47.8%</td>
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<td>47.4%</td>
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<tr>
<td>c. bananas (% food crops)</td>
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<td>409.0</td>
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<td>434.9</td>
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<td>3.7%</td>
<td>4.2%</td>
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<td>4.3%</td>
<td>4.0%</td>
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<tr>
<td>f. sorghum (% food crops)</td>
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<td>29.4</td>
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<td>36.1</td>
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<td>g. sorghum (kg/capita)</td>
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<td>3,423.0</td>
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<td>3,812.6</td>
<td>3,864.6</td>
<td>3,493.5</td>
<td>3,309.1</td>
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<td>4,335.3</td>
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<tr>
<td>h. total food crops (000 tons)</td>
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<td>3,423.0</td>
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<td>3,812.6</td>
<td>3,864.6</td>
<td>3,493.5</td>
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<td>4,975.2</td>
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<td>b. bananas (% food crops)</td>
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<td>37.5%</td>
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<td>c. sorghum (million FRW)</td>
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<td>5.9%</td>
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<td>7.0%</td>
<td>7.4%</td>
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</table>
### APPENDIX TABLE A.12

**TRENDS IN AVAILABILITY OF PRIMUS, OUIBAR AND IMPORTED LIQUOR**

1. **Primus**
   - **quantity sold (million liters)**
     - 1961: 5.4
     - 1962: 8.7
     - 1963: 5.0
     - 1964: 8.2
     - 1965: 8.7
     - 1966: 12
     - 1967: 11.9
     - 1968: 12.3
     - 1969: 12.3
     - 1970: 14.3
     - 1971: 16.1
     - 1972: 17.1
     - 1973: 19.4
   - **price (F Ru per bottle)**
     - 1967: 14
     - 1968: 14
     - 1969: 14
     - 1970: 14
     - 1971: 12
     - 1972: 12
     - 1973: 12
   - **tax (F Ru per bottle)**
     - 1967: 11
     - 1968: 11
     - 1969: 11
     - 1970: 11
     - 1971: 13
     - 1972: 13
     - 1973: 13
   - **retail price (F Ru per bottle)**
     - 1967: 35
     - 1968: 35
     - 1969: 35
     - 1970: 35
     - 1971: 36
     - 1972: 36
     - 1973: 36
   - **retail sales (million F Ru)**
     - 1967: 576.5
     - 1968: 597.9
     - 1969: 597.9
     - 1970: 695.1
     - 1971: 805.0
     - 1972: 831.3
     - 1973: 970.0

2. **Ouibar**
   - **quantity wine sold**
     - 1961: 0
     - 1962: 0
     - 1963: 0
     - 1964: 0
     - 1965: 0
     - 1966: 0
     - 1967: 0
     - 1968: 0
     - 1969: 0
     - 1970: 0
     - 1971: 0
     - 1972: 0
     - 1973: 0
   - **value (F Ru million)**
     - 1967: 0
     - 1968: 0
     - 1969: 0
     - 1970: 0
     - 1971: 0
     - 1972: 0
     - 1973: 0
   - **retail sales (F Ru million)**
     - 1967: 0
     - 1968: 0
     - 1969: 0
     - 1970: 0
     - 1971: 0
     - 1972: 0
     - 1973: 0

3. **Hard Liquor and Imported Wine**
   - **import value, CIF (F Ru million)**
     - 1967: 10.6
     - 1968: 35.7
     - 1969: 34.9
     - 1970: 34.1
     - 1971: 38.3
     - 1972: 39.2
     - 1973: 46.7

### Source: