Ghana School Feeding Program: Markets, Value Chains and Menu Optimization

June 12, 2008

Jessica Lopatka
Jason Topel
Pedro de Vasconcellos
Agenda

- Executive Summary
- Price Trends
- Market Sizing
- Nutritional Optimization
- Value Chain Analysis
- Conclusions
Executive Summary

• After three weeks, the Berkeley team has come away extremely impressed with the progress of the GSFP to date

• Our report identifies the following insights for the GSFP using three separate forms of analysis:
  o Price Trends and Market Sizing
    ▪ GSFP staple crops continue to rise considerably in price
    ▪ Market created by GSFP is not easily quantifiable, and should be more transparent to all parties involved
  o Nutritional Optimization
    ▪ The current allocation of 30 pesewas per day is not sufficient to provide meals that meet key nutritional requirements.
    ▪ Menus should be constructed and caterers should be trained to ensure all meals are optimized for cost and nutritional content
  o Value Chain Analysis
    ▪ Constraints exist that prevent small farmers from selling to GSFP schools
    ▪ Focus on organization, transparency of market information, and partnerships
Price Trends for Key GSFP Food Staples

- Data obtained from TradeNet, cross-checked with data from MofA
- Markets grouped into regional areas (south, central, north)
- Data aggregated by regional area and nationally
- Price projections made based on historical data

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Rice</td>
<td>0.68</td>
<td>0.96</td>
<td>41.18%</td>
<td>29.6%</td>
<td>1.24</td>
</tr>
<tr>
<td>Cassava (Gari)</td>
<td>0.53</td>
<td>0.74</td>
<td>39.62%</td>
<td>37.0%</td>
<td>1.01</td>
</tr>
<tr>
<td>White Maize</td>
<td>0.34</td>
<td>0.65</td>
<td>91.18%</td>
<td>43.2%</td>
<td>0.67</td>
</tr>
<tr>
<td>Millet</td>
<td>0.61</td>
<td>0.55</td>
<td>-9.84%</td>
<td>20.9%</td>
<td>0.66</td>
</tr>
<tr>
<td>Plantain</td>
<td>0.37</td>
<td>0.61</td>
<td>64.86%</td>
<td>0.4%</td>
<td>0.61</td>
</tr>
<tr>
<td>Palm Oil</td>
<td>0.76</td>
<td>1.43</td>
<td>88.16%</td>
<td>51.3%</td>
<td>2.17</td>
</tr>
</tbody>
</table>

- Prices of these staples have increased an average of 52.5% since the inception of the program
Local Rice

- Prices have been increasing in southern and central regions
  - 30% over last 12 months
  - Sharp increase (20%) from April 2008 to May 2008
- Rice production decreased by 26% from 2006 to 2007
Local vs. Imported Rice

• Some schools have recently been purchasing imported rice for use in GSFP meals
  o Caterers reported that imported rice is less expensive in markets, and that children have grown accustomed to the taste.
Plantain

- Prices of plantain align closely with the seasonality of the fruit
  - Schools do not purchase when out of season
  - Caterers must make substitutions when plantain appears on recommended menu
Maize

- Majority of maize produced in Ashanti, Brong Ahafo, and Eastern regions (“central”)
- Demand is low in the northern regions and higher in south, which explains differences in prices
Key Takeaways from Price Trend Analysis

• Prices continue to rise for all GSFP food staples.
• The quality and quantity of meals provided will decline without additional funds.
  o 46 pesewas has the same purchasing power today as 30 pesewas did at the start of the Program.
  o Is that enough?
• Menus should account for seasonality in certain staples.
Market of Key GSFP Food Staples

Process:

- Menus for central and southern regions collected from GSFP
- Total GSFP market demand for each crop projected based on quantities of staples used (per school caterers) and current enrollment figures

<table>
<thead>
<tr>
<th>Food Staple</th>
<th>2007 Production (metric tons)*</th>
<th>Current GSFP Demand (metric tons)</th>
<th>Total GSFP Market (Ghana Cedis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>1,219,600</td>
<td>2,866</td>
<td>1,222,200</td>
</tr>
<tr>
<td>Rice</td>
<td>185,340</td>
<td>4,812</td>
<td>4,190,740</td>
</tr>
<tr>
<td>Cassava</td>
<td>10,217,930</td>
<td>1,083</td>
<td>727,100</td>
</tr>
<tr>
<td>Plantain</td>
<td>3,233,745</td>
<td>903</td>
<td>498,647</td>
</tr>
<tr>
<td>Total</td>
<td>14,856,616</td>
<td>9,664</td>
<td>6,638,692</td>
</tr>
</tbody>
</table>

* Source: Statistics, Research and Info. Directorate (SRID), Min. of Food & Agric.- Dec, 2007
Projected Increase in Market Created by GSFP
For example, 5.5% of the local rice produced in the southern regions has the potential to be consumed by the GSFP schools within those regions.
Key Takeaways from Demand Analysis

- Demand will continue to rise with the expansion of the GSFP program.
- Rice comprises the largest portion of the market GSFP creates for farmers.
- Cassava production far outweighs demand by GSFP schools.
- Menu variability contributes to uncertainty in demand figures.
Nutritional Optimization

• Goal: Develop a meal that meets all nutritional requirements at the lowest possible cost

• Methodology: Development of a linear programming model that incorporates nutritional data and costs for select meal ingredients
Nutritional Requirements

• Recommended Daily Allowances (RDAs):

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Energy (kcal)</th>
<th>Protein (g)</th>
<th>Vitamin A (µg)</th>
<th>Iron (mg)</th>
<th>Folate (mg)</th>
<th>Zinc (mg)</th>
<th>Calcium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6 years</td>
<td>1,700</td>
<td>30</td>
<td>500</td>
<td>10</td>
<td>200</td>
<td>10</td>
<td>500</td>
</tr>
<tr>
<td>7-10 years</td>
<td>2,400</td>
<td>34</td>
<td>700</td>
<td>10</td>
<td>300</td>
<td>10</td>
<td>800</td>
</tr>
</tbody>
</table>

• GSFP meals should provide one-third of the calories, one-third of the protein, and two-thirds of the micronutrients suggested by the RDAs.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Energy (kcal)</th>
<th>Protein (g)</th>
<th>Vitamin A (µg)</th>
<th>Iron (mg)</th>
<th>Folate (mg)</th>
<th>Zinc (mg)</th>
<th>Calcium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6 years</td>
<td>567</td>
<td>10</td>
<td>333</td>
<td>7</td>
<td>133</td>
<td>7</td>
<td>333</td>
</tr>
<tr>
<td>7-10 years</td>
<td>800</td>
<td>11</td>
<td>467</td>
<td>7</td>
<td>200</td>
<td>7</td>
<td>533</td>
</tr>
</tbody>
</table>
# Nutritional Content of Ingredients

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Size of One Unit</th>
<th>Energy (kcal)</th>
<th>Protein (g)</th>
<th>Vitamin A (mcg)</th>
<th>Iron (mg)</th>
<th>Folate (mcg)</th>
<th>Zinc (mg)</th>
<th>Calcium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>100g</td>
<td>130</td>
<td>2.38</td>
<td>0</td>
<td>1.49</td>
<td>58</td>
<td>0.42</td>
<td>3</td>
</tr>
<tr>
<td>Maize</td>
<td>100g</td>
<td>108</td>
<td>3.32</td>
<td>0</td>
<td>0.61</td>
<td>46</td>
<td>0.48</td>
<td>2</td>
</tr>
<tr>
<td>Cassava (Gari)</td>
<td>100g</td>
<td>160</td>
<td>1.36</td>
<td>1</td>
<td>0.27</td>
<td>27</td>
<td>0.34</td>
<td>16</td>
</tr>
<tr>
<td>Millet</td>
<td>100g</td>
<td>119</td>
<td>3.51</td>
<td>0</td>
<td>0.63</td>
<td>19</td>
<td>0.91</td>
<td>3</td>
</tr>
<tr>
<td>Plantain</td>
<td>100g</td>
<td>116</td>
<td>0.79</td>
<td>2</td>
<td>0.58</td>
<td>26</td>
<td>0.13</td>
<td>2</td>
</tr>
<tr>
<td>Palm Oil</td>
<td>10g</td>
<td>86</td>
<td>0</td>
<td>2500</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Yam</td>
<td>100g</td>
<td>116</td>
<td>1.49</td>
<td>6</td>
<td>0.52</td>
<td>16</td>
<td>0.2</td>
<td>14</td>
</tr>
<tr>
<td>Cowpeas</td>
<td>100g</td>
<td>97</td>
<td>3.17</td>
<td>40</td>
<td>1.12</td>
<td>127</td>
<td>1.03</td>
<td>128</td>
</tr>
<tr>
<td>Groundnut</td>
<td>100g</td>
<td>318</td>
<td>13.5</td>
<td>0</td>
<td>1.01</td>
<td>75</td>
<td>1.83</td>
<td>55</td>
</tr>
<tr>
<td>Fish</td>
<td>100g</td>
<td>203</td>
<td>23.03</td>
<td>36</td>
<td>2.92</td>
<td>12</td>
<td>1.31</td>
<td>74</td>
</tr>
<tr>
<td>Chicken</td>
<td>100g</td>
<td>146</td>
<td>30.39</td>
<td>0</td>
<td>1.41</td>
<td>5</td>
<td>1.27</td>
<td>17</td>
</tr>
</tbody>
</table>

Source: United States Department of Agriculture
Details of the Optimization Model

• Objective: Minimize total meal cost

• Constraints:
  o All nutritional requirements for the given age group must be met or exceeded
  o Certain ingredients have lower and/or upper bounds (e.g., cereals have a lower bound of one cup)
  o At least one staple cereal (rice, maize, cassava, millet) must be included in meal
  o At most one animal protein (chicken, fish) may be included in meal
  o Cowpeas can only be used with maize or gari (cassava)

• Assumptions:
  o Prices used are current values (May 2008)
  o Ingredients used as flavorings (e.g., onions, peppers, tomatoes) are not included
Executing the Model

- Model run under four scenarios:
  - Southern regions, 4-6 year olds
  - Central regions, 4-6 year olds
  - Southern regions, 7-10 year olds
  - Central regions, 7-10 year olds

- Appropriate regional price data and nutritional requirements used for each scenario

- Model not executed for northern regions because current price data was not available
Model Results

- Optimal Meal for 4-6 year-olds in southern regions:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Total Quantity in Meal</th>
<th>Total Cost (Ghana Cedis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassava</td>
<td>1.00 cups</td>
<td>0.094</td>
</tr>
<tr>
<td>Palm Oil</td>
<td>0.17 Tb</td>
<td>0.004</td>
</tr>
<tr>
<td>Cowpeas</td>
<td>0.72 cups</td>
<td>0.117</td>
</tr>
<tr>
<td>Groundnut</td>
<td>1.61 cups*</td>
<td>0.349</td>
</tr>
</tbody>
</table>

**Total Cost of Meal (Ghana Cedis)**: 0.565

- Other scenarios produced meals with similar ingredients:
  - Total meal costs range from 53 to 77 pesewas per child

*Note: Quantity of groundnut represents cooked, whole groundnuts that should be used to make groundnut paste*
# Nutritional Content of Optimal Meal

## Nutritional Content of Meal: 4-6 years, South

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Minimum Amount Required</th>
<th>Amount Provided by Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>567</td>
<td>1277</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>10</td>
<td>44</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>333</td>
<td>642</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Folate (µg)</td>
<td>133</td>
<td>405</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Calcium</td>
<td>333</td>
<td>333</td>
</tr>
</tbody>
</table>

- **Abundance of calories required to meet nutritional requirements**
- **Nutritional requirements hardest to meet**
Sensitivity Analysis

• Remove constraints to see how outputs of the model change

• Removal of constraints on meal ingredients:
  o Optimal meal contains millet, cowpeas and palm oil
  o Cost drops to 39 pesewas in central regions
  o Represents absolute minimum cost possible while still meeting nutritional requirements

• Relaxation of micronutrient requirements:
  o Providing only ½ of the required zinc and iron reduces the total meal cost to 45 pesewas in the southern regions
Conclusions from Nutritional Optimization

• The current allocation of 30 pesewas per child per day is not sufficient to meet the nutritional requirements of the children being served by GSFP.
  o Other cost considerations that are paid for with the 30p:
    ▪ Other ingredients used in meals (tomato, onion, pepper, etc.)
    ▪ Water
    ▪ Salaries of caterers and cooks
    ▪ Kitchen Supplies

• Menus should be re-examined and caterers should be trained to ensure meals meet RDA requirements.
  o Include portion sizes
  o Expand menu to cover more than one week
  o Account for seasonal or unavailable ingredients
Value Chain Analysis

• Purpose: Identify opportunities for key market players to capture more value from the market

• Our focus: Identify constraints in the value chain preventing small farmers from supplying GSFP schools

• Four food staples considered:
  o Maize
  o Rice
  o Cassava
  o Palm Oil
Maize Value Chain

Farm Gate → Local production → Own Consumption
Local Market → Retailer → Consumers
Regional Market → Trader → Wholesaler (Market Queen) → Retailer → Consumers

Own Consumption
Maize: Importance and Seasonality

• Importance and Prevalence:
  o Predominant cereal crop in Ghana
  o Production exceeds that of rice, millet and sorghum combined
  o Mostly used for human consumption
  o 50% consumed on farm, remaining sold in urban food markets or to agro-processors

• Seasonality:
  o One major season planted in April, harvested in August
  o Minor season planted in August, harvested in early January
Maize: Production and Processing

• Production:
  o Small farmers: produce primarily for subsistence
  o Small farmers who have farming contracts with large aggregator or wholesaler typically have higher yields

• Processing:
  o Many small-scale local millers
  o Significant unexploited market niche for drying services
  o Only 13% of maize consumed in Ghana processed by agro-processors
Maize: Sales

• Sales:
  o Individual farmers can sell directly to traders or to local markets
  o Often forced to sell at low prices because of:
    ▪ Lack of storage and drying facilities
    ▪ Immediate need for cash (school fees, etc.)
    ▪ Contracts/Financing agreements
  o Traded maize ends up in wholesale markets where “market queens” act as influential traders
    ▪ Provide financing tied to price and supply agreements
    ▪ Control storage facilities at markets
Maize: Opportunities for Small Farmers

• Organization into cooperatives
  o Ability to supply schools in aggregate
  o Manpower to organize financing, collective storage and drying facilities, group purchasing, etc.

• Increased access to market information
  o Ability to leverage market data in sales negotiations (TradeNet)

• Leverage existing knowledge base
  o Form partnerships with organizations who can help farmers gain more power in the value chain
    ▪ TechnoServe, Self Help International, GAABIC
Analysis of Other Food Staples

- Other crops considered have value chains similar to that of maize.

- Specific takeaways:
  - **Rice**
    - Increasing demand offers incentives for farmers to produce more
  - **Cassava**
    - Potential to vertically integrate with grinding
  - **Palm Oil**
    - Quality is often an issue
    - Farmers are capturing value, processors are facing constraints
Acknowledgements

• We are deeply indebted to the following individuals who were exceedingly generous with their time and expertise over the past three weeks. Without them, our work would not have been possible.
  o GSFP: Nana Ayim Poakwah, Andrew Kessie, Selti Offei, Dwomoh Mensa Robert
  o Institute of Industrial Research: Dr. Essel Ben Hagan
  o UNDP: Frank McAvor, Rafael Flor
  o Millennium Cities Project: Abenaa Akuamoah-Boateng
  o Dutch Embassy: Marius de Jong
  o IFDC: Marjatta Eilitta, Patrice Annequin, Victor Attuquaye Clottey
  o WFP: Sibi Lawson-Marriott
  o Ministry of Agriculture: Kwadwo Adarkwa, Giorgina Nkunu, John Nortey
  o TIPCEE: Jean Michel Voisard
  o Numerous Headmasters, Headmistresses, Teachers and Students at the schools and regional offices we visited in and around Accra and Kumasi