COMPARATIVE ADVANTAGE OF SUGARCANE PRODUCTION IN PAKISTAN

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ABSTRACT

This study was undertaken in 2003-04 to determine the competitiveness of sugarcane production in North West Frontier Province (NWFP) of Pakistan. Another major objective of the study was to determine whether Pakistan qualifies for the export of sugarcane/sugar or should produce sugar as import substitution strategy to ensure food security. The Policy Analysis Matrix (PAM) depicts that sugarcane production is more nationally profitable for import substitution than sugarcane production as export promotion objective. The Domestic Resource Cost (DRC) and Social Benefit-Cost (SBC) analysis also confirm the above analysis of competitiveness of sugarcane production in the project area. This implies that the current sets of sectoral and macroeconomics policies are not consistent with the national policy objectives of agricultural development. The results of PAM analysis suggest that sugarcane could be nationally produced as an import substitution strategy for self-sufficiency, while its production should be discouraged for export purpose. This study further recommends that Pakistan's top management and policy makers should make serious efforts to make both sectoral and macroeconomic policies consistent with national goals of agricultural development, trade and food security.

I. INTRODUCTION

The sweetener industry in Pakistan largely consists of sugarcane production, manufacturing and marketing of white sugar and gur. Sugarcane production in Pakistan is characterized by a shorter than normal growing cycles and relatively low yields as compared to international standards i.e., 60 tones (GoP, 2003). Its share in value added in agriculture and gross domestic product (GDP) are 4.2 and 1 percent, respectively (Economic Survey, 2003). The sugar industry contributes around Rs. 4 billions under the head of excise duty. The industry directly employs over seventy-five thousands people, including managers, technicians, engineers, financial experts, skilled and unskilled workers (Alam and Khan, 2001). The sugar industry holds a relatively important position in agriculture, agribusiness and food consumption. In agribusiness, sugar is second in total sales after textiles (Shabbir, 2000). To the consumer, sugar is an essential commodity like vegetable ghee or flour. Because of the size of the sugar industry and its importance to the consumer, sugar is subject to a number of policies and government interventions.
The policy structure in Pakistan is fairly complex and a number of agencies are involved in the formulation of sugar policy. The leading role in policy making, however, appears to be that of the Ministry of Food and Agriculture and the various committees including Agriculture Price Commission and All Pakistan Sugarmills Association. The sugar policy suffers from a number of weaknesses. These include: a) an excessive preoccupation with short-term considerations; b) a lack of economic policy analysis capability in the relevant ministries; c) a single-crop approach to pricing policies which does not adequately take into account the effects of support prices on other crops; and d) ineffective involvement of growers and other stakeholders (Shamim, 2000).

**Need for Effective Research on Sugar Industry**

Since cost of sugar production is very high due to low yield, low sucrose content, high support price of cane, and high cost of cane processing with heavily taxed sugar industry. On the other hand, we have very significant investment in sugarcane sub sector and sugar industry. Millions of people have jobs in sugarcane and sugar related activities. It will not be rational to quit sugar production only because of high production cost relative to the cost of other sugar producing countries.

Therefore, a comprehensive research and policy analysis is needed for all the factors at the farm level and at the industry level that causes low profits for the farmers and high cost of sugar production.

The literature shows that Sugar industry in Pakistan operates without any definite policy framework. The industry, which is the second largest after textile industry and has a direct bearing on the lives of millions of farm workers, is at the mercy of those who hardly understand industry mechanics. The decision-makers are very sensitive to any increase in sugar prices but are least concerned about spending millions of dollars on ill-timed import of sugar. Other interest group tries to protect sugarcane growers by simply increasing its support price however; still another group resist any increase in sale price of sugar. The millers face problems whether there is a shortage in sugarcane supply or surplus production of sugar (Shabbir, 2000).

The current trends of competitiveness in the world trading systems in general, and deregulation move by World Trade Organisation (WTO) of agricultural sector in Pakistan in particular suggest that we can no longer continue our traditional administered and insulated agricultural economy. We should rather manage our agriculture by formulating well-defined and well-analysed policies in line with global trends in agricultural markets. This study is an attempt to analyse present agricultural outlook and policies to re-orient them according to the WTO agreement and at the same time ensuring maximum prices and income to Pakistan's sugarcane farmers and sugar producers.

**Objectives**

The more specific objectives of the study are to:

a. Determine the comparative advantage (national profitability) and competitiveness (private profitability) of sugarcane in NWFP.
b. Determine whether Pakistan qualifies for export/import of and/or should produce sugarcane as import substituting strategy to ensure food security.

c. Draw policy implications of the research findings for development of future agricultural policy and long-term investment in sugarcane production and sugar industry.

II. MATERIAL AND METHODS

The study was conducted inCharsadda and Mardan districts during 2003-04. Keeping in view the financial and time constraints, a sample of one hundred and twenty farmers was selected from both districts in such a manner to obtain maximum and reliable information in addition to the equal representation of all farmers in the research area.

Multi stage sampling technique was carried out using stratified random sampling. It was decided to select eight villages out of three hundred and ninety total villages (GoP, 1998) using proportional allocation method, i.e.,

\[ n_i = n \frac{N_i}{N} \]

for \( i = 1, 2, ..., k \).

Where \( N_i \) is the total number of villages in ith tehsil, \( n \) is the total number of villages to be sampled (8), \( N \) is the total number of villages in all tehsils (390) and \( n_i \) is the number of villages to be subsampled in ith tehsil.

The numbers of villages were allocated as:

\[ n_1 \text{ (for tehsil Charasadda)} = \frac{8 \times 147}{390} = 3.01 = 3 \]

\[ n_2 \text{ (for tehsil Tangi)} = \frac{8 \times 53}{390} = 1.08 = 1 \]

\[ n_3 \text{ (for tehsil Mardan)} = \frac{8 \times 140}{390} = 2.87 = 3 \]

\[ n_4 \text{ (for tehsil Takhhtbhai)} = \frac{8 \times 50}{390} = 1.02 = 1 \]

(The values for the number villages has been rounded to highest significant digit)

Based on the above formula a random sample of three villages each was selected from Charsadda and Mardan tehsils, while one village each was randomly selected from Tangi and Takhhtbhai tehsils. An equal sample of fifteen farmers from each selected village in the first stage was interviewed, which were the second stage units. Hence, a total of one hundred and twenty farmers were sub sampled from the sampled villages using a pre-designed interview schedule/questionnaire.

The Analytical Framework

The PAM is particularly attractive due to its simple but comprehensive matrix formulation which clarifies a very complex relationship among farm-level activities, domestic and international market opportunities and macro economic variables, and offers an unusually clear framework to measure patterns of comparative advantage and policy effects on agriculture.
The PAM is designed as a matrix of enterprise budgets indicating cost and revenue structures, including the profits measured in private (market) as well as national terms. Thus, by filling the elements of the PAM in Table 1 the first column gives budget for private profitability (competitiveness) valued at market prices and the second reveals national profitability (comparative advantage) at opportunity costs. The third column shows the effects of divergences i.e., the effects of policy as the difference between private and national profitability. These divergences are transfers within the national economy in the case of imperfect market.

Table 1. The structure of the policy analysis matrix (PAM).

<table>
<thead>
<tr>
<th></th>
<th>Private Budget at Mkt. Prices</th>
<th>National Budget At Nat. Opp. Costs</th>
<th>Effects of Divergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>A</td>
<td>F</td>
<td>K^4</td>
</tr>
<tr>
<td>Labor costs</td>
<td>B</td>
<td>G</td>
<td>L^4</td>
</tr>
<tr>
<td>Capital costs</td>
<td>C</td>
<td>H</td>
<td>M^4</td>
</tr>
<tr>
<td>Tradable input costs</td>
<td>D</td>
<td>I</td>
<td>N^4</td>
</tr>
<tr>
<td>Profits</td>
<td>E^1</td>
<td>J^1</td>
<td>O^1</td>
</tr>
</tbody>
</table>


Notes:  
^1Net Private Profitability (NPP), E = (A-B-C-D).  
^2Net National Profitability (NNP), J = (F-G-H-I).  
^3Output Transfers, K = (A - F).  
^4Labor Market Distortions L = (B-G).  
^5Capital Market Distortions M = (C-H).  
^6Other inputs Transfers N = (D-I).  
^7Total Policy Effects 0, = (E-J) = (K-L-M-N) = (NPP-NSP) = PSE_{Total}

Net Private Profitability (NPP): The Competitiveness

In the PAM context, private profitability (E) is defined as the difference between revenues (A) and costs (B, C, D) valued at observed market prices. The calculation of net private profitability at the farm level is routinely done by economists working in Farming System Research (FSR) projects. In countries where FSR or other farm-level studies exist, applications of PAM are greatly facilitated (N.P. Khan, 1997).

Net National Profitability (NNP): The Comparative Advantage

Determination of national profitability is the most crucial component of the PAM analysis. The PAM applies cost-benefit analysis and basic concepts of international trade theory to determine national opportunity costs of inputs and outputs and hence profits. World prices are taken as efficiency prices for tradable inputs and outputs after proper adjustment for foreign exchange (Using Prevailing Official Exchange Rate at the time of analysis i.e.,
Comparative advantage of sugarcane

1S=58.7 Pakistani Rupees), policy transfers and all intermediary margins, including processing, transporting, and marketing (SBP, 2003). Once the social values for inputs and outputs are estimated, the calculation of NNP follows easily. For this study, import parity price (cif: cost insurance and freight) was used for import substitution and food security and export parity price was used for producing sugar for export purpose.

In the PAM analysis, national profitability (J) is defined as the difference between revenue (F) and costs of domestic factors (G, H) and tradable inputs (I) priced at national opportunity cost values. This is shown in the third column of Table 11 across the rows of the matrix. The national valuation eliminates the underlying economic costs of sub optimal policy intervention and market imperfections, and therefore NNP is the measure of comparative advantage.

Effects of Divergences or Policy Effects in the Context of PAM

The policy analysis or divergences between private and national values are the second fundamental identity in the PAM framework. In the PAM analysis, the divergences are explained by policy intervention that alter the incentives of the decision-makers (farmers) and cause a divergence between private and national prices. The PAM analysis allows not only quantification of the overall effects of government policies on the incentives of the farmers but also explains the impacts of individual policies by desegregating the overall divergences into their constituent’s parts. The fourth column of Table 1 across the rows of the matrix summarizes the individual as well as the overall policy effects on the incentives to an activity as follows.

The overall net policy affects on the incentives facing the farmers (0) equals the output effects (K) less the labor market transfer (L) less the capital transfer (M) less the tradable input effects. The net transfer can also be found by subtracting national profitability from private profitability (0 = E - J). This kind of analysis is useful to know whether the activity is profitable because of policy incentives (J < 0, O > 0) or because of natural and true comparative advantage (J > 0). More specifically, the positive value for policy effects indicates that the government policies have supported the activity and private profitability has increased. While the negative value means the opposite i.e., those resources are transferred from this particular activity and private production is discouraged (N.P. Khan, 1997).

PAM’s Standard Measures of Comparative Advantage

National profitability and the divergence of private profitability from national profitability are simple measures of comparative advantage and policy effects. They are useful to compare enterprises with the common numeraire but become of less importance to compare activities (usually agricultural activities) that are measured in different units. The PAM framework’s flexibility allows combination of its elements into ratios and unit free measures of comparative advantage and policy effects that provide an alternative to compare activities with different units of measurement and scale of operations are as follow.

1. Domestic Resource Costs Ratio (DRC) $(G + H)/(F - I)$.

The DRC ratio measures an activity's contribution to national income and thus comparative advantage by quantifying the opportunity costs of domestic resources used in per unit of tradable value added of that activity, both measured at national (optimal) prices in local currency. In the PAM notation, DRC = (G + H)/(F - I). In this ratio, G and H are costs of domestic factors (i.e., land, labor and capital) while F is revenue and I are the costs of the tradable inputs of the activity. The difference (F - I) is tradable valued added of the activity when everything is valued at social opportunity cost. The social benefit-cost (SBC) ratio is another measure of efficiency that can be derived from PAM. In the PAM context, SBC = F/(G + H + I), where G, H, I are the costs of tradable and non-tradable inputs and F is the revenue both valued at national prices (N.P. Khan, 1997).

III. RESULTS AND DISCUSSION

Estimation of PAM Budgets

The PAM budgets condense most of the calculations behind the PAM into a single page. For convenience, the rows and columns of the PAM are transposed from their conventional lay out so that the rows list budget items, in terms of their PAM category (capital, labor and tradable inputs).

The capital and labor categories include resources used directly and indirectly in sugarcane production. The tradable input category includes only the tradable component of inputs and marketing services that has different procedure to convert it into shadow prices.

The initial two columns of PAM budgets list the budget items and their total values at market prices. Third column contains the opportunity cost values of input and output of budget items that are obtained by multiplying tradable input values in fourth row with 6 percent foreign exchange premium calculated from dividing shadow exchange by official exchange rate. The last column of PAM budgets shows any transfers of resources from and to sugarcane farmers.

Market prices for output are the prices offered by the sugar mills i.e. Premier Sugar Mills Mardan and Frontier Sugar Mills Takht Bhai per 40kg. Total revenue of the output is the yield multiplied by cane price per 40 kg (Rs.42) plus the imputed value of cane tops and dry leaves per acre. The national opportunity costs values are calculated by multiplying the output by the import parity price for import substitution and by export parity price for export promotion purpose.

In the PAM budgets, labor is the next item listed after output. There is a separate listing of labor used directly in irrigation, besides labor used directly in other farm activities. Labor markets in Pakistan are considered relatively free, so market prices can be used as reasonable measure of its opportunity costs.

After output and labor, the next item in the PAM budget is capital. Capital includes interest, land rental value and capital resources that are used indirectly in sugarcane production and marketing. Market price of the land is the land rental value. The shadow price of land has been estimated by determining the social profitability of land in the best alternative enterprise for NWFP.

The last but not the least important item of PAM budgets is tradable inputs that are used directly or indirectly in producing and marketing of agricultural products. This category includes the tradable portion of all intermediate inputs other than labor and capital. The
opportunity costs of tradable inputs are calculated by multiplying the tradable values with the foreign exchange premium of 6 percent.

Policy Analysis Matrix Results

Policy Effects: The Divergence Between Private and National Profitability

In the PAM analysis, the divergences are explained by policy interventions that alter the incentives of the decision-makers (farmers) and cause a divergence between private and national profitability.

Table 2. PAM Results of sugarcane 2003-04.

<table>
<thead>
<tr>
<th></th>
<th>Market Price</th>
<th>Opportunity cost</th>
<th>Transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>23301.7</td>
<td>25099.8</td>
<td>-1798.1</td>
</tr>
<tr>
<td>Labor</td>
<td>3928.6</td>
<td>3928.6</td>
<td>0</td>
</tr>
<tr>
<td>Capital</td>
<td>8108.1</td>
<td>7953.6</td>
<td>154.5</td>
</tr>
<tr>
<td>Traded</td>
<td>5540.4</td>
<td>5872.9</td>
<td>-332.5</td>
</tr>
<tr>
<td>Profits</td>
<td>5799.2</td>
<td>7345.1</td>
<td>-1545.9</td>
</tr>
</tbody>
</table>

Source: Author's calculation from PAM budgets.

Table 2 summarizes the results of comparative advantage of sugarcane when grown as a strategy for import substitutions by incorporating import parity price. The transfers occur in the output, labor, capital and tradables markets, as well as in profitability. The transfers in the output market in all cases are from farmer to society because the market price of cane per 40 kgs in the research area was PKRs. 42 while the import parity price was PKRs. 45.2 per 40 kgs (GoP, 2002). As labor market is considered as free, therefore the transfers in labor market are zero. The transfers in the tradable market are from farmers to society, indicating the government policy of subsidizing tradable goods. The aggregate policy affects shows that generally the production of sugarcane is discouraged and not supported by policy incentives in the research area. The results clearly indicates that producer price policy has curtailed the private profitability of farmers, receiving less than the world prices during 2003-04 harvest year.

Table 3. PAM Results of sugarcane 2003-04.

<table>
<thead>
<tr>
<th></th>
<th>Market Price</th>
<th>Opportunity cost</th>
<th>Transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>23301.7</td>
<td>14937.9</td>
<td>8363.8</td>
</tr>
<tr>
<td>Labor</td>
<td>3928.6</td>
<td>3928.6</td>
<td>0</td>
</tr>
<tr>
<td>Capital</td>
<td>8033.4</td>
<td>7953.6</td>
<td>79.8</td>
</tr>
<tr>
<td>Traded</td>
<td>5540.4</td>
<td>5872.9</td>
<td>-332.5</td>
</tr>
<tr>
<td>Profits</td>
<td>5799.2</td>
<td>-2817.4</td>
<td>8616.6</td>
</tr>
</tbody>
</table>

Source: Author's calculation from PAM budgets.

Table 3 provides all the relevant data using export parity price of cane, when sugarcane production was analyzed for export promotion. The market values of the output was much higher than its opportunity cost value, due to the very low export parity price of PKRs. 26.9 per 40 kg compared to the market price of PKRs. 42 per 40 kg (GoP, 2002). Transfers in the
labor market were zero. Negative transfers in tradable market indicate that farmers were paying over and above for tradable goods than its cost to society. The positive values of total policy effects in the last row of transfer’s column represent that cane production was encouraged and supported by policy incentives. Hence producer price policy had enhanced the private profitability of farmers. Farmers received more than the world prices during 2003/04 harvest year.

**Profitability of Sugarcane Production**

Private profitability is defined as the difference between revenues and costs valued at observed market prices. Table V summarizes private and national profitability of sugarcane in the research area considering cane cultivation as an import substitution strategy and export oriented enterprise. The net national profitability differs from private profitability in pricing the revenues and costs at national opportunity costs values instead at market prices.

Most of the changes in estimating national profitability occurred due to the opportunity cost of land and the use of export and import parity prices instead of market prices. The national profitability value of the enterprise is encouraging (PKRs.7345.5) considering cane cultivation for import substitution. On the other hand the research area doesn’t have comparative advantage as export promotion regime as confirmed by negative national profitability. The main factor behind this phenomenon was the very low export parity price of cane i.e. PKRs. 26.9/ 40kgs (GoP, 2002). The analysis revealed that sugarcane couldn’t be grown for export promotion given the current agricultural conditions and policies. The figures, however, reflects that cane enterprise can be undertaken with high comparative advantage for import substitution or food self-sufficiency.

**Domestic Resource Costs (DRC) Analysis: The Measure of Comparative Advantage**

The DRC analysis is a great achievement toward the development of more practical measures of comparative advantage. This ratio can be used to compare different economic activities in terms of national costs of domestic resources employed in earning or saving a unit of foreign exchange.

The smaller the national cost of transforming domestic resources to yield a unit of foreign exchange, the more efficiently the country uses its scarce resources. The relationship between DRC and comparative advantage is straightforward: a country has a comparative advantage in an activity if DRC ratio is less than unity. Conversely, a DRC ratio greater than unity indicates inefficiency of the country in producing that particular commodity.

**Table 4. PAM’s Standard measure of comparative advantage.**

<table>
<thead>
<tr>
<th></th>
<th>Import Substitution</th>
<th>Export Promotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Profitability (Rs)</td>
<td>5799.2</td>
<td>5799.2</td>
</tr>
<tr>
<td>National Profitability (Rs)</td>
<td>7345.1</td>
<td>-2817.4</td>
</tr>
<tr>
<td>DRC</td>
<td>0.59</td>
<td>1.31</td>
</tr>
<tr>
<td>SBC</td>
<td>1.41</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Source: Author's calculation from PAM budgets.
Table 4 shows the values of DRC analysis of sugarcane in the research area. The DRC coefficient of 0.59 for the study area confirms the overwhelming competitiveness of sugarcane in the research area undertaken for import substitution while the case is opposite for export promotion, reflecting comparative disadvantage. The DRC value of 1.31 shows that we can earn/save one rupee by employing our domestic resources of Rs. 1.31 in sugarcane production.

**Social Benefit-Costs (SBC) Analysis: The Measure of Comparative Advantage**

As the name suggests, Social Benefit-Costs (SBC) ratio is the ratio of the net social benefits to the national opportunity costs of resources that may accrue to the use of these resources in the production activity. The Social Benefit-Cost (SBC) ratio is the most effective technique to prioritize alternative activities when the shadow exchange rate is well estimated. The numerator is the social benefits, while the denominator is the social costs of economic resources employed in creating the value added. The relationship between SBC ratio and the measure of comparative advantage is straightforward: A country is an efficient producer of a commodity if SBC ratio is greater than unity, but less than one suggests that production of that commodity is not profitable for the country.

The SBC ratios 1.41 and 0.84 means that we can earn/save foreign exchange 1.41 and 0.84 times more as compared to its costs by investing in sugarcane production, respectively confirming comparative advantage for import substitution and disadvantage in the case of export promotion.

**IV. CONCLUSION AND RECOMMENDATIONS**

In this study, the Policy Analysis Matrix (PAM) framework was used to determine the private profitability (competitiveness) and net national profitability (comparative advantage) of sugarcane production in NWFP. To determine whether policy incentives have favored or discriminated against cane activity. Another major objective of the study was to determine whether the research area qualifies for export of cane and/or should produce cane as import substitution strategy to maximize self-sufficiency and to ensure food security. Other conventional measures of comparative advantage (DRC and SBC) were calculated from PAM framework.

The major objectives of Pakistan food policy are maximum self-sufficiency, equitable distribution of food at reasonable prices and to promote food exports. Sugarcane is an important cash crop of Pakistan. It is mainly grown for sugar and sugary products. It is an important source of income and employment for the farming community of the country. Area under sugarcane has increased over time, but the increase in productivity per unit area has been very low, ranging between 45-60 tons/ha while, the average yield of sugarcane around the world is around 60 tons/ha (Alam and Khan, 2001). Therefore, efforts should be made to improve its productivity. As a result of these efforts substantial improvement can take place in its yield. Improved seed production, quality control and distribution depend largely upon the availability of skilled and competent manpower, which is insufficient in most developing countries. It was realized during this study that low support price of sugarcane encouraged to a large extent, the diversion of cane to gur making.
Conclusion

The results obtained from PAM budgets analysis and standard measures of comparative advantage and policy effects are concluded as follow.

The analysis revealed that national profitability was positive if the enterprise is undertaken for import substitution and negative when carried out for export promotion. These results indicated that cane enterprise could be undertaken as a measure of import substitution, but not for export promotion. As most of the cane production is utilized by the sugar industry, generalizing the data we can say that Pakistan should produce sugar as a measure of import substitution for which it has high comparative advantage, instead using it for export promotion where it has comparative disadvantage. Another reason which can be put forward in the support of the above statement is, that despite having the potential for surplus production of sugar, Pakistan cannot utilize sugar for export, because the prevailing prices of sugar in the international market are far below the cost of production in Pakistan.

Recommendations

Some policy recommendations coming out of this study are already spelt out. The most obvious policy implications are laid as follow.

1. The farmers, agricultural scientists and policy makers in Pakistan should put emphasis on increasing cane yield rather than increasing price support. Price support improves farmer's income in the short run but for sure increase the production cost of cane in the long run due to price support capitalization into the land values.

2. Up to date and timely information regarding inputs, inputs prices especially availability of improved cane varieties, output market prices, and agricultural and macroeconomic policies should be ensured which are important parameters to improve the competitiveness and comparative advantage of sugarcane farmers.

3. It was realized during this study that there is food policy crisis rather than food crisis in Pakistan. A serious and sincere effort is needed on the part of policy makers of the country to make agricultural, trade and micro-macro policies consistent with our food policy objectives to achieve food self sufficiency and ensure cheaper and safer food to the people.

LITERATURE CITED


Comparative advantage of sugarcane


