Assessing the Competitiveness of Groundnut Production in Malawi: A Policy Analysis Matrix Approach

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Abstract

Groundnut is an important component of the national food supply. It does not only have nutritional and dietary value, groundnut also provides cash to farmers; enrich the soil with nitrogen through biological nitrogen fixation; and its haulms can be used as fodder and fuel.

Groundnut production has not kept up with the demands both local and export markets especially in terms of volumes over time. This has been in part due to low average yields resulting from continuous use of unimproved seed. In turn Malawi's groundnut exports have also generally dwindled over time.

The analysis of Malawian groundnut production using the Policy Analysis Matrix methodology shows that both traditional and improved technology groundnut production are both privately and socially profitable. This leads to the conclusion that protectionist policies that would raise domestic groundnut prices above the import parity prices determined in world markets are unnecessary.

However, investments in improved technology show profits that are greater than traditional technology. These are likely to be areas in which government investments would yield a significant rate of return and reduce dependence on world markets. In addition to investments in improved seed technology, government should also invest in improved technologies for post harvest handling.

1.0 Introduction

This study is an application of a Policy Analysis Matrix (PAM) to assess the competitiveness of Malawian Groundnut, which is mainly produced by smallholder farmers under a wide range of heterogeneous conditions. The PAM has been widely used to analyze private and social profitability and competitiveness for a variety of farming systems under different technological and institutional scenarios (Nelson and Panggabean 1991, Yao 1997, Fang and Bengxin 2000, Pearson, Gotsch, and Bahri 2003, Nguyen and Heidhues 2004, Yercan and Isikli 2006). This study attempts to measure the efficiency of smallholder groundnut production.

Groundnut is one of the most important food legumes in Malawi's subsistence farming communities. Apart from its nutritional and dietary value, groundnut provides cash to farmers after the sales of groundnut surplus. Groundnuts, being a leguminous crop, enrich the soil with nitrogen through biological nitrogen fixation and are therefore valuable in crop rotations and soil improvement. Groundnut hauls are also valuable as fodder for animals and fuel.

However, groundnut production faces several production constraints including droughts and erratic rainfall patterns. Its productivity is also affected by poor local markets, poor pricing structure and lack of lucrative export markets. The poor price structure is a disincentive to increase production because groundnut is a labor intensive crop and the low prices mean that farmers cannot make a profit and therefore cannot increase the area of production. The export market creates demand and hence drives the production (Minde et al, 2008).

The paper investigates two groundnut cropping systems: a traditional system and a cropping system using improved technology. The traditional system is one in which groundnut farmers use traditional seed (mainly chalimbana) that is of low quality. These seeds are either taken from previous harvest or bought at the local market. Most of them are unbranded and are only for household consumption. Mostly it is seed which has been recycled for many decades. On the other hand, improved technology systems use high quality seed (such as CG7). This seed has already proved that it can increase productivity significantly. In both groundnut cropping systems, farmers mostly practice monoculture.

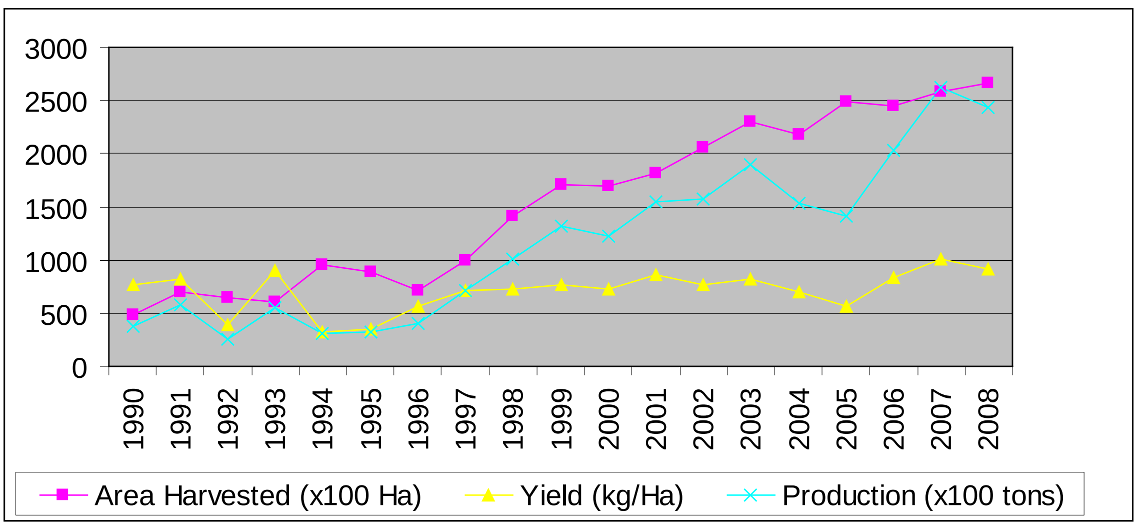
1.1 Malawi Groundnut Production and policy

The major crops of the legume sub-sector in Malawi in terms of both value and quantity comprises of groundnuts, Pigeon peas, Common beans, cowpeas and soybeans.
Groundnut is the most widely cultivated legume in Malawi, which accounts for 25 percent of household's agricultural income (Diop et al. 2003). The crop provides a number of benefits to smallholder farmers: for example, a) groundnut fixes atmospheric nitrogen in soils and thus improves soil fertility and saves fertilizer costs in subsequent crops, b) forms an important component of both rural and urban diet through its provision of valuable protein, edible oil, fats, energy, minerals, and vitamins. This crop is consumed as such or roasted or processed into oil. In livestock-farming communities, groundnut can be used as a source of livestock feed and increases livestock productivity as the groundnut haulm and seed cake are rich in digestible crude protein content.

Groundnut production in Africa has suffered from fluctuations and downward trend. Yields are still very low, averaging about 800 kg ha-1, less than one-third the potential yield of 3000 kg ha-1. This large gap between actual and potential yields is due to several factors, including non-availability of seed of improved varieties, poor soil fertility, and inappropriate crop management practices, low inputs used in groundnut cultivation as well as pests and diseases (Mahmoud et.al., 1992).

In Malawi, Groundnut production has been declining steadily over the years until 1996 when production started rising (Fig 1). The declining trend could be ascribed to several factors. Malawi Government pricing policy before liberalization of the market in the late 1980s made the growing of groundnuts less profitable both in nominal and real terms relative to hybrid maize and tobacco (Monyo et al, 2007).

In addition, the export prospects have been declining due to importers' preferences against the bigger sizes "Malawi nuts" (e.g. Chalimbana). Domestically, the country experienced the drought that hit most sub-Saharan Africa coupled with rosette disease attack in most areas of the country during the 1991 to 1994 seasons. Data from the past years reveal that the highest groundnut production was obtained in 1985/86 season, and the lowest in 1991/92 season when the crop was devastated by drought (Malawi Government, 1998). The overall groundnut production constraints are - declining of producer prices, use of low yielding varieties, inferior cultural techniques, prevalence of foliar diseases such early and late leaf spot and groundnut rosette diseases and extended dry spells within the growing season (Nyirenda, 1992; Luhana et al. 1994; Subrahmanyam, et al. 1997; Chiyembekeza et al., 1998).



Source FAOSTAT 2010

Figure1. Groundnut production trends in Malawi

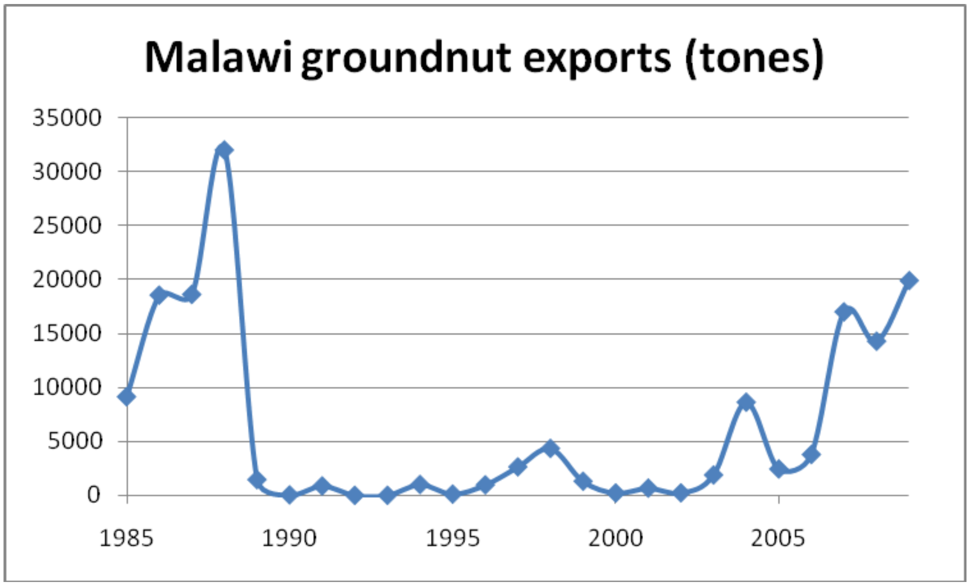
As Figure 1 shows, there has been increase in groundnut production, area planted with groundnuts as well as groundnut yield. However it is important to note that the yields still remain at about one third of the potential yield per hectare. The increase in production and yield between 1995 to the present could be attributed to the injection of improved adapted varieties and recommended practices into the system.

Malawi's agricultural development process historically can be categorized in three phases. The first phase, spanning up to 15 years after independence (1961-1984), was characterized by active government involvement in the economy and agricultural sector (Chirwa, 2007). The main objective of policies during this period was to diversify the economy away from the agricultural sector through increased import-substitution and industrialization, thereby generating sustainable employment opportunities (Chirwa, 2007).

The second phase, also known as the reform phase, spanned for another 15 years from 1980 to 1994. In this period, the government adopted several structural adjustment policies proposed by the World Bank, including the liberalization of the marketing of agricultural inputs and produce. One of the main objectives of market reforms was to eliminate direct and indirect taxation of farmers that had undermined production incentives in the 1970s and early 1980s and led to underutilized processing capacities in many groundnut producing countries (Badiane and Kinteh 1994). Malawi government therefore under the auspices of the World Bank liberalized prices of most crops in 1988 with the state marketing agency ADMARC, acting as a buyer of last resort at minimum guaranteed pan-territorial and pan-seasonal prices. Private traders were allowed to participate in the marketing of agricultural produce such that by 1995 prices of all other crops, except for maize, were fully liberalized (Chirwa, 1998). This meant that private traders were free to determine their own prices for the purchase of crops from smallholder farmers.

The third phase, the period from 1995 onwards, is regarded as the post-reform period, a period after major structural reforms under structural adjustment period were completed in most sectors of the economy. The phase is characterized by a formulation and adoption of a number of development policy frameworks, including the Malawi Poverty Reduction Strategy (MPRS) of 2002 and the Malawi Economic Growth Strategy (MEGS) of 2004. This phase is also characterized by the reversal of many of the structural adjustment and marketing policies that were adopted during the reform phase. For example, the state marketing agency – ADMARC - has once again become an important player in the marketing of maize and other crops. The continued participation of ADMARC has partly been attributed to the sluggish response of the private sector taking up marketing activities following liberalization.

Simtowe et al (2009) indicated that the post-reform phase and the second round of the reform phase are characterized by high growth rates in groundnut harvested area; yield, as well as production. They further showed that the first round of the post-reform period (1995-2000) registered the highest groundnut annual rates of growth in production (28.7%), yield (15.3%), harvested area (15.7%), and oil production (30.9%). This is apparently because of a sharp rise in the yield and production between 1995 and 1996. This rise is also reflected in figure 1. The growth can also be seen as a supply response following the liberalization of the marketing of agricultural produce during the preceding reform phase. Malawi's groundnut exports dropped sharply from about 30 tons in 1988 to zero exports in 1989 as shown in figure 2. The exports remained low after 1990 despite the reforms in the local markets until 2004 when groundnut exports increased to about 10 tons. This was largely due to the poor quality of groundnut resulting from high aflatoxin levels. Exports have been fluctuating since although there is a steady increase in general from 2004 till 2009. Simtowe et al 2009 further reveal that these findings could suggest that while market reforms helped in sustaining production increase, they failed to sustain growth in groundnut exports. Therefore emphasis in current policies should focus on supporting the production of high quality groundnuts with lower aflatoxin levels.



Source FAOSTAT 2010

Figure2. Groundnut exports trends in Malawi

2.0 The Policy Analysis Matrix (PAM)

The PAM is a computational framework which was developed by Monke and Pearson (1987) and augmented by Masters and Winter-Nelson (1995). It is used to address three central questions of agricultural policy analysis. First, PAM helps to asses whether agricultural systems are competitive under existing technologies and prices. This entails whether farmers, traders and processors earn profits facing actual market prices. Secondly, PAM measures the impact of new public investment in infrastructure on the efficiency of agricultural systems. Efficiency is measured by social profitability, the valuation of profits in efficiency prices. Thirdly, it measures the impact of public investment in agricultural research or technology on the efficiency of agricultural systems. Successful investments in new seeds, farming techniques or processing technologies would enhance farming or processing yields and thus would increase revenues or decrease costs.

PAM is therefore a budget based method for quantitative economic policy analysis, which allows for the evaluation of public investment projects and government policies in the agricultural sector (Monke and Pearson 1989, Pearson, Gotsch, and Bahri 2003). Budgets are calculated to assess private and social profitability of production systems employed in different farming systems. Private budgets are based on current market prices faced by farmers, while social budgets are based on social prices that account for government policies that may influence market prices such as taxes, subsidies etc.

The construction of PAM for an agricultural system allows one to calculate private profitability- a measure of the competitiveness of the system at actual market prices. The basic format of PAM as shown in Table 1 is a two-way accounting identities.

Table 1. Policy Analysis Matrix

	Value of Output	Value of Input		Profit
		Tradable	Domestic factor	
Private Prices	A	B	C	N
Social Prices	D	E	F	O
Policy Transfer	G	H	I	P

Source: Monke and Pearson, 1989

Private profit: N=A− (B+C)

Social profit: O=D− (E+F)

Output transfer: G=A−D

Input transfer: H=B−E

Factor transfer: I=C−F

Net policy transfer: P=N−O

The calculation of private profitability or competitiveness is carried out in the first row of the PAM matrix. The private profitability (N) is defined as the difference between observed revenue (A) and costs (B+C). The private profitability demonstrates the competitiveness of the agricultural system, given current technologies, prices for input and output, and policy. The second row of the matrix calculates the social profit that reflects social opportunity costs. Social profits measure efficiency and provide a measure of comparative advantage. In addition, comparison of private and social profits provides a measure of efficiency. A positive social profit indicates that the country uses scare resources efficiently and has a static comparative advantage in the production of that commodity at the margin. Similarly, negative social profits suggest that the sector is wasting resources, which could have been utilized more efficiently in some other sector. In other words, the cost of domestic production exceeds the cost of imports suggesting that the sector cannot survive without government support at the margin. The third row of the matrix estimates the difference between first and second rows. The differences between private and social valuations of revenues, costs and profit can be explained by the effects of policy interventions. The PAM framework also enables to calculate important indicators for policy analysis. Nominal protection coefficient (NPC), a simple indicator of the incentives or disincentives in place, is defined as the ratio of domestic price with a comparable world (social) price. NPC can be calculated for both output (NPCO) and input (NPCI). The domestic price used in this computation could be either procurement price or farm gate price while the world reference price is the international price adjusted for transportation, marketing and processing costs. The other two indicators that can be calculated from PAM include the effective protection coefficient (EPC) and domestic resource cost (DRC). EPC is a ratio of value added in private prices (ÃB) to value added in social prices (E-F). An EPC value of greater than one suggests that government policies provide incentive to producers and less than one indicates that producers are not protected through policy interventions. DRC, the most useful indicator of all the three, used to compare the relative efficiency or comparative advantage between agricultural commodities and is defined as the shadow value of non-tradable factor inputs used in an activity per unit of tradable value added (F/ (D-E)). The DRC indicates whether the use of domestic factor is socially profitable (DRC<1) or not (DRC>1). Although the DRC indicator is widely used in academic research, its primary use has been in applied works by World Bank, Food and Agriculture Organization, International Food Policy Research Institute in the developing countries to measure comparative advantage. However, DRC may be biased against activities that rely heavily on domestic non-traded factors such as land and labor. A good alternative for the DRC is the SCB, which accounts for all costs (Fang and Beghin, 1999). The SCB is calculated as the ratio of (E+F)/D. Higher values of SCB suggest stronger competitiveness and vice-versa.

3.0 Data and Modeling Assumptions

The data used to construct PAM in this study include groundnut yields, inputs and the market prices for inputs and output per hectare of land. Additional data such as transportation costs, port charges, storage costs, import/export tariffs and exchange rate were also used to calculate social prices. In this study, PAM is computed for groundnuts local varieties and improved varieties for 2006/2007 growing season. The production data used is the average of data from four districts selected from central and southern parts of Malawi. The data was collected by the International Crops Research Institute for the semi-Arid Tropics (ICRISAT), in collaboration with the centre for Agricultural Research and Development of the University of Malawi and the National Smallholder Farmers Association (NASFAM) in April-May 2008 in Malawi.

The most difficult task was estimation of social prices for outputs and inputs just like Yao (1997) reported that it can be cumbersome to estimate social prices and decompose inputs into their tradable and non-tradable components. However, Monke and Pearson (1989) suggested that since decomposing all input costs is a tedious task and has very insignificant effect on results. Therefore some inputs such as land, labor, farm capital depreciation, animal power and manure are assumed to be totally non-tradable.

World prices (FAOSTAT, 2010) were used as reference in estimating the social prices for both groundnut inputs and output. The social prices for domestic factors of production (labor and land in this case) were estimated by application of the social opportunity cost principle. Since these factors are not tradable opportunity costs are estimated through observations of rural factor markets in the study area.

For Labor market, it was observed that fragmentation is minor because there was no big difference in its price across similar sub-markets. The labor providers could easily move into and out of the existing sub-markets. This is strong evidence that there are no existing monopsonies and oligopsonies in the rural labor sub-markets. Although Malawi has a minimum wage law but it is not well enforced in subsistence agriculture sector. Since this law is ineffective and does not change labor costs in this sector it was ignored in this PAM analysis.

Based on Gulati and Kelly (2000) findings, the social valuation of land is calculated as the ratio of net returns to land to average of NPCOs of competing crops. Alternatively, the social value of land can be estimated through the social opportunity cost principle. From the point of view of the national economy, the social land rental rate is found by estimating the social profit (H) of the land in its best alternative use when all costs of land are excluded. For example, the social cost of using a plot of land to grow groundnuts in one season is found by estimating the foregone social profit from not planting that land to the next most profitable crop (e.g., Tobacco). However, this approach requires the one to identify the best alternative crop and to carry out a full PAM analysis on it.

Because of the difficulty and expense of studying alternative crops to estimate social land rental rates, a different approach was considered. Profitability included returns to land and management (rather than only returns to management). Land costs then were omitted from both private and social calculations.

4.0 Results and Discussions

4.1 Social Profitability and Financial Competitiveness

The results of the PAM estimates for social profitability and financial competitiveness for both traditional and improved groundnut systems are shown in Tables 2, 3, 4, and 5.

4.1.1 Groundnut production using traditional technology

Table 2. PAM calculation using traditional system

	Revenues	costs		profits
		input	factor	
Private	32101.00	4097.00	10070	17934.00
Social	43229.10	5677.50	10070	27481.60
Transfers	-11128.10	-1580.50	0	-9547.60

In table 2, private revenue was MK 32101, and social revenue was MK 43229.10. The differences in revenues could be attributed to the effect of market liberalization where vendors offer very low farm gate prices to producers. Private profit in amount of MK 17934 shows actual profit that will be received by the farmers with traditional technology. The social profit (MK27481.60) shows that the system is profitable and has a comparative advantage. Even though the results show that local groundnut production is profitable at both private and social prices, the net profit transfer indicates otherwise. Since the net profit transfer is negative (-MK9547.60), the net effect of the policies was to tax the groundnut local technology. These results show that groundnut production, even using traditional technology, does not require any protection or subsidy to yield substantial profit. The transfers on revenue were negative showing that groundnut production using local technology was being taxed probably through the low selling prices of groundnuts. However, for the resource costs, the tradable input transfer (MK-1580.50) was negative indicating that the farmers were paying lower prices for the inputs. There was an implicit subsidy decreasing the distribution cost of tradable inputs from supplier to farmer. These costs are therefore not paid by farmers.

4.1.2 Groundnut production using improved technology

Improved technology in this paper is defined by use of high-yielding groundnut varieties. The private profit shown in Table 3 (MK 20167.56) is the actual profit obtained by farmers using the improved cropping system. The social profit, MK 30489.45, is computed using social prices. Both private and social profits are positive, again implying that groundnut production with improved technology was profitable at both private and social prices.

Table 3. PAM calculation using improved technology system

	Revenues	Costs		Profits
		Input	factor	
Private	34334.56	4097.00	10070	20167.56
Social	46236.95	5677.50	10070	30489.45
Transfers	-11902.385	-1580.50	0	-10321.90

The negative input transfers (Mk -1580.50) are due to the fact that social prices are higher than private prices. This shows that farmers were buying subsidized inputs. This is caused in part by the local pricing of seed which is not so much different from that of grain. Most farmers purchase seed locally which is not properly packaged and not from the seed companies. Those that buy well packaged seed then they are beneficiaries of the farm input subsidy program. Lower private prices also result from implicit subsidy on the distribution of tradable inputs from suppliers to farmers. An example of reduced distribution costs are the distribution of inputs to rural areas by the government through the subsidy program. Since the difference between private and social profits is negative (-MK10321.90), the overall effect of the policy was to tax the improved technology.

4.2 Policy Indicators

From the entries of PAM, NPC, EPC DRC and SCB were calculated for both local and improved groundnut technologies. The results are presented in tables 4 and 5. The summary results on protection coefficients on groundnuts for Malawi are reported in

Table 4. The NPCO coefficients for both local and improved groundnut are lower than one indicating that domestic prices in Malawi are below their corresponding international reference prices. Similarly, NPCI values of less than one in both cases suggest that the government policies are reducing input costs for groundnuts. NPC values of less than one for input and output markets imply government efforts in supporting the groundnut sector by subsidizing the inputs.

Table 4. Summary Results of the Protection Coefficients for local and improved groundnuts (2006/2007).

	Local groundnuts	Improved groundnuts
NPCO	0.74	0.74
NPCI	0.72	0.72
EPC	0.75	0.75

However, the EPC is a more reliable indicator of the effective incentives than the NPC, as the former recognizes that the full impact of a set of policies includes both output price enhancing (import tariffs) and cost reducing (input subsidies) effects. The EPC nets out the impact of protection on inputs and outputs, and reveals the degree of protection accorded to the value added process in the production activity of the relevant commodity. Just like the NPCs, the EPC values in Table 4 do not show any differences in the degree of policy transfer for local and improved groundnuts in the study area. The EPC reveals that Malawian groundnut farmers face a net tax of about 25 percent on their value added.

Table 5. Results of the State wise Indicators for groundnuts (2006/2007)

	indicator	value
Local Groundnuts	DRC	0.27
	SCB	0.36
Improved Groundnuts	DRC	0.25
	SCB	0.34

The other PAM indicators (DRC and SCB) used in this paper for groundnuts are reported in Table 5. These indicators reaffirm the conclusions reached with the protection coefficients earlier. DRC values for groundnuts are much lower than one clearly indicating that Malawi has a comparative advantage in groundnuts. This also means that groundnut is efficiently produced in Malawi. Although not significant, there is a slight difference in DRC values for local and improved groundnuts with the later being lower than the former. This might suggest that Malawi has a relatively higher comparative advantage in producing improved groundnut varieties than the local ones. This result based on DRC values is supported by the fact that identical revelation is obtained using the SCB values (Table 5). Overall, the results suggest that groundnuts production in Malawi is competitive and can not be seriously affected by government withdrawal of the existing support currently given to this crop.

4.3 Cross Comparisons

The PAM results in Tables 2 and 3 shows that local and improved groundnuts technology were both privately and socially profitable. Although private and social profits are positive, there are negative divergences of -MK9547.60 and -MK10321.90 for local and improved technologies, respectively. The implication of this is that the net effect of the policies was to tax these technologies.

In both technologies, the NPCs on output were less than 1 and were the same, thus implying that these groundnut technologies were facing negative incentives. In other words, the domestic groundnut producers were being taxed i.e. groundnut production was earning revenues, which were about 25 percent lower than the ideal situation. Since the NPCIs for both local and improved groundnuts were less than 1, it indicates that the adopters were facing positive incentives to buy tradable inputs.

The EPC for both local and improved groundnut technology was 0.75. Since the EPC is less than one but positive, it implies that the combined effect of transfers and tradable inputs was reducing the private profitability of the technologies. The DRC for local (0.27) and improved (0.25) technologies were less than one and positive. This reveals that both technologies were socially profitable to the society as a whole. This indicates that the value added well exceeds the opportunity cost of using domestic resources.

In summary, local and improved groundnut technologies have comparative advantage since they are socially profitable at both private and social prices. Groundnuts production in Malawi can therefore profit both the adopters and society at large. It seems clear that any existing unilateral or multilateral trade liberalization of the groundnuts sector in Malawi can not have serious implications for the sector because cultivated land may not be diverted from groundnuts to more profitable crops.

Conclusion

This paper applied a policy analysis matrix (PAM) to the groundnut sector in Malawi. Based on PAM calculations, the system using improved technology provides higher private and social profits than the system using traditional technology. Both traditional and improved technology systems provide high social profits. However, both local and improved technologies are socially and financially profitable.

The PAM indicators suggest that groundnut is efficiently produced in Malawi. Improved varieties of groundnuts have a slightly higher comparative advantage than their local counterparts. This finding is consistent with the government policies of improving grain production through high procurement price and subsidization of inputs. However, government subsidy and protection to groundnut production are unnecessary.

The general conclusion from this analysis is that Malawi has a comparative advantage in producing groundnuts especially the improved varieties. In addition, Malawi producer prices are lower than the world prices. Therefore groundnut production should be encouraged so that farmers can benefit from the unilateral and multilateral trade relationships that exist by exporting groundnuts to these markets.

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