Competitiveness and Policy Analysis of Potato Production Under Different Agro-Ecological Zones of Northern Areas: Implications for Food Security and Poverty Alleviation

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ABSTRACT

The study applied Policy Analysis Matrix (PAM) to determine competitiveness and policy effects of potato production in the three agro-ecological zones of district Gilgit. Another major objective was to determine whether Northern Areas of Pakistan qualify for the export of potato or should produce potato as import substitution strategy to ensure food security and alleviation of poverty.

The PAM analysis showed that the Domestic Resource Cost (DRC) values are less than unity (0.27 - 0.28) for import substitution regime in all the three agro-ecological zones which confirm the regions comparative advantage in producing potato as import substitution while its values higher than unity (1.02 - 1.11) for export promotion regime show the regions comparative disadvantage in producing the potato for export purpose. The Social Benefit Cost (SBC) ratios for import substitution regime are greater than unity (2.79 - 3.00) and its values less than unity (0.93 - 0.99) for export promotion regime also supplement the regions comparative advantage in import substitution and disadvantage in export promotion respectively. It was also found that single cropping zone in the research area is more competitive than marginal double cropping and double cropping zones for import substitution.

The values of Nominal Protection Coefficient (NPC) for import substitution regime in all the three agro-ecological zones are less than unity (0.54 - 0.59) which means that the farmers are receiving less than the world prices. The NPC value for export promotion are greater than unity (1.61-1.78) which means that the farmers are receiving more than world reference prices due to the subsidies. Similarly, the values of Effective Protection Coefficient (EPC) show that for import substitution regime, input and output were taxed and for export promotion regime, the prices are protected and positive incentives to the farmers. This implies that the current sets of agricultural and macro-economic policies are consistent with competitiveness of potato production for import substitution, but are not consistent for export promotion. The analysis further revealed that marketing and transportation, fertilizer, land preparation and land rent were the major items of cost in potato production.

The study strongly recommends that to compete in international markets, we have to strengthen our competitiveness in potato production by improving potato yield and ensuring world level prices to potato growers. Finally, government should launch awareness program about improved farm technologies, crop management through strengthening of agriculture extension services and trade liberalization process in Northern Areas.

Introduction

Potato (*Solanum tuberosum* L.) belongs to Solanaceae family. It is the most important dicotyledonous tuber crop and possesses major socio-economic importance worldwide. It is the fourth most cultivated food crop after wheat, rice and maize in world. About 325 million metric ton of potato is produced annually throughout the world (World Book, 2001). Potato is a good and cheaper source of carbohydrates, vitamins, minerals and proteins and also provides most of the trace elements, which can meet the energy requirement of the people living in the developing

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countries like Pakistan (Rahman, 1986). This crop is financially more remunerative than cereals from food security and can be recommended as a partial replacement of cereals.

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Nature has bestowed Pakistan with diverse agro-climatic conditions. In the plains, we are raising two crops of potato namely spring and autumn crops while third one is grown in hilly areas during summer season. In Pakistan, currently potato is grown on 109.7 thousand hectares producing 1938.1 thousands ton annually with an average yield of 17.7 tons/ha. (Agricultural Statistics of Pakistan, 2003-2004). Agricultural Statistics shows that in Pakistan the area and the production of potato have increased from 72 thousand hectares and 751.3 thousands ton in 1990-91 to 109.7 thousand hectares and 1938.1 thousands ton in 2003-04 respectively. Similarly, the per hectare yield has also increased from 10.4 to 17.7 tons/ha. during the same period. The increase in the area, production and yield is 52.36,157.95 and 70.10 percent during 1991 to 2004 (Agricultural Statistics of Pakistan, MINFAL, Islamabad, 2003-04). The increase in production can be attributed due to increase in area under potato, disbursement of credit to potato growers, availability of sufficient soil moisture at sowing time, availability of certified seed potato and optimal use of production inputs like seeds, fertilizers and chemicals and improved crop management practices.

Due to extensive research and continued efforts put by agricultural scientists over the last few decades, Pakistan has achieved great improvement in potato yield; however it is still very low as compared to other potato producing countries (FAO, 2004). Potato is assuming great importance as food and cash crop in Pakistan but the per hectare yield of potato is still low as compared with other main potato growing countries of the world. The main causes of low yield are non availability of disease free certified seed potato and lack of improved crop management practices.

The Northern Areas is situated in the extreme north of the country .The Northern Areas officially named as Federally Administered Northern Areas (FANA), comprised of six administrative districts of Gilgit, Diamer, Ghizer, Baltistan, Ghanche and Astore. The total area is 72,500 square kilometers with a population of over one million living in 831 villages with a population density of 12 persons per sq km. Majority of the area is mountainous and roughly one percent of the area is under agriculture while rest is covered by mountains, rivers and glaciers (66 percent), rangelands (23 percent) and forest (4 percent) (IUCN, 2002).

Agriculture is the mainstay of the people of the area. More than 96 percent of the population directly or indirectly depends upon agriculture. The climate (severe cold in winter, cool spring and hot and dry summer) is ideally suited for the cultivation of vegetables and deciduous fruits. The major crops grown are wheat, maize, vegetables (especially potato as

major cash and staple crop) and temperate fruits (apricot, apple, cherry, peach, grape, pear etc). Table 1.2 shows the land utilization in Northern Areas. Out of the total cultivated land of 58,607 hectares, the area under Rabi and Kharif crops are 48065 and 25995 hectares respectively which are 82.01 and 44.35 percent of the total cultivated land. Similarly the area under potato crop is 3275 hectares which is 5.58 percent of the total cultivated land.

Table 1.1 Land Utilization in Northern Areas, Pakistan

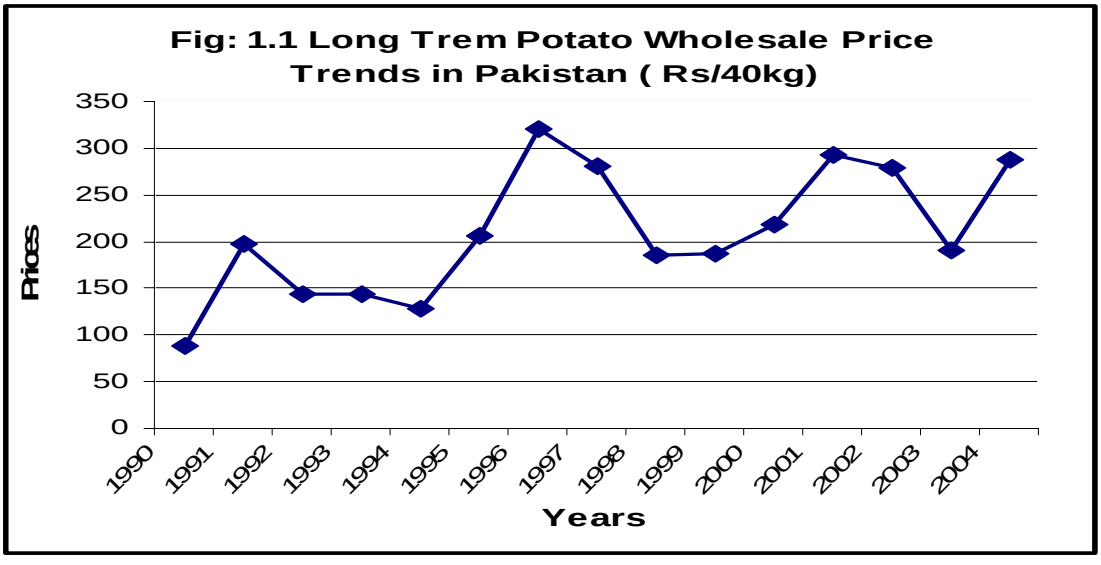
Classification of Cropped Area	Area (hectares)	Percentage
Total area	80,223	
Cultivated Area	58,607	
Uncultivated area	21,616	
Area under Rabi crop	48,065	82.01
Area under Kharif crop	25,995	44.35
Area under Fruits	5,230	8.92
Area under Vegetable	4,155	7.08
Area under Potato	3,275	5.58

Source: GoP, Agriculture Census Report, Northern Areas, 2000

Gilgit District is the headquarter of Northern Areas of Pakistan. The crops grown are wheat, maize, potato, vegetables and fruits. Potato has been emerged as commercial cash crop in the district over the last two decades which is mostly cultivated in the high elevated valleys of the district due to availability of ideal climatic conditions. Hot sunny days and cool nights prevailing in these high valleys make the conditions conducive for the production of this crop. In these valleys, potato crop is sown during March to April and harvested in August-October as summer crop in the country. The per hectare potato yield is 23.64 ton as compared to rest of the country's potato growing area (17.7 ton) which is declining over the period of time due to lack of crop rotation, lack of proper technology, timely availability of inputs and rising production costs (Socio Economic Survey Northern Areas, PARC, 2003). The marketable surpluses are sold in the main markets as buffer crop between spring and autumn crop of plains that fetches reasonable prices for the growers.

Looking at export and import situation in Pakistan, potatoes exports are greater than its imports which means that the country is self sufficient in potato. In 2004, Pakistan's population of over 150 million people consumed nearly two million tons of potatoes. Average annual per capita consumption would thus be over 12 kg (FAO, 2005). Pakistan being self sufficient in potato, but the perishable nature and seasonal supplies of this commodity cause the prices of potato fluctuate quite widely. In the year of bumper harvest, market prices reach the lowest level that even can not meet the transportation charges from farm to markets. In the year of low production, the prices reach the skies badly affecting the consumers as indicated in Figure 1.1.

To save the farmers against the adverse consequences of gluts and assuring the adequate supplies to the consumer, the government was including potato among the crops covered under support price programme. In the year 1997-98, the government fixed the support price of potato at Rs. 145 per 40 kgs. During autumn crop harvesting season (1997-



98), market prices in the wake of bumper production ruled much below the support price fixed by the government. The support price policy implementing agency (PASSCO) was unable to undertake potato procurement operations and refused to pick up operational losses of procurement. So farmers had to dispose off their surplus produce at uneconomic prices. In this context, potato farmers are estimated to have a loss of over Rs. 5 billions (Agricultural Prices Commission, 1998-99).

Such situations also affect the potato growers of Northern Areas as well. Potato is the only cash crop and its economic significance can not be ignored. However, low yield and highly volatile market prices have been subject to instability due to a number of problems i.e., lake of management, high prices of inputs, uncertain climatic conditions (frost damage) and inconsistent and contradictory agricultural and macroeconomic policies. These problems have not only seriously affected the producer welfare but also the consumer welfare as well. Besides this, the current trade liberalization trend under WTO suggests that production, consumption, income of potato farmers will be affected a lot due to open competition in international markets. We can manage this problem by judicious use of available resources and a proper mix of government policies and market forces. There is urgent need to launch studies related to competitiveness and policy analysis of potato production. Policy Analysis Matrix (PAM) is important tool to determine the competitiveness of potato production and its trade and to know whether the current set of policies are consistent with existing competitiveness and trade

liberalization under WTO (Byerlee 1989; Nelson and Panggabean 1994; Zakir, 2000; Khan 2001; Asif, 2003; Aman 2003 and Rehman; 2005). This study was designed to: i) estimate competitiveness of potato production and policy analysis in the three gro-ecological zones of Northern Areas and ii) draw policy implications with special reference to food security and poverty alleviation.

Materials and Methods

Sampling Design

The peculiar climatic conditions prevailing in district Gilgit, the altitude plays pivotal role in determining the cropping patterns of the area. The agro-ecological zones are hence classified on the basis of altitude accordingly. Table 1.2 shows the agro-ecological zones of the area and their respective cropping patterns that are also explained in the following paragraph.

Table 1.2: Agro-Ecological Zones and Cropping System in District Gilgit

Agro-Ecological Zones	***Altitude (meters)***	***Area***	***Cropping System***
Double Cropping Zone	Below 1600	Basin, Juglote, Oshikhandas, Danyore, Nomal, Shikeot, Heramosh etc.	a) Wheat-Maize b) Berseem - Maize c) Potato - Maize
Marginal Double Cropping Zone	1600 – 2400	Nasirabad, Hassanabad, Aliabad, Karimabad, Sumayar,	a) Wheat- Buck wheat b) Potato - Barley c) Vegetable Fodder
Single Cropping Zone	2400 – 3000	Upper Hunza, Naltar, upper Nagar, Bagrote (Chirrah) etc.	Wheat/Barley/ Potato/ Black Beans/Peas

Source: *(GoP, Socio-Economic Survey of Northern Areas, PARC, Islamabad, 2003)*

Keeping in mind the lack of resources, time and remoteness of valleys, two villages from each stratum (agro-ecological zone) were selected through purposive sampling technique. In these villages, potato crop is intensively grown as a cash crop. The sampled villages representing their respective cropping zones are indicated in Table 1.3.

Table. 1.3: Agro-Ecological Zone Wise Sample Villages Selected in District Gilgit

S. No.	***Agro-Ecological Zones***	***Villages***	***No. of Sampled Farmers***
1	*Double cropping Zones*	Rahim Abad,	23
		Sikandarabad	23
2	*Marginal Double Cropping Zone*	Nasirabad	39
		Hassanabad	11
3	*Single Cropping Zone*	Khyber	8

		Hakalshal Hoper	45

From the above selected villages, the proportionate allocation sampling technique was used to get the required sample size of 149 farmers (10 percent of the total households in selected villages). Several authors have used this sampling technique and Prof. S. M. Chaudhry, 1997, P.18 has also suggested to use this process for sampling in the above like situation.

Collection of Data:

The primary data on cost of potato production and marketing was collected through personal interviews and discussions made with the respondents using a pre prepared and pre tested interview schedule. The primary data was further supplemented by the available secondary data about input and output market and fob/cif prices, macroeconomic variables such as inflation, interest rates, exchange rates, import/export taxes etc. obtained from different national and international sources.

Analytical Framework: The Policy Analysis Matrix (PAM) Paradigm

Applied economists use a variety of techniques to measure competitiveness and policy effects. Trade economists (e.g., Corden 1966) generally use Domestic Resource Cost (DRC), Nominal and Effective Protection Coefficients (NPC and EPC), while project appraisal economists (e.g., Gittinger 1982) typically use Social Benefit-Cost (SBC) Ratio. Agricultural trade specialists (e.g., Josling 1973) have developed new indicators such as Producer Subsidy Equivalent (PSE) and Subsidy Ratio to Producers (SRP). Recently, several studies have used Policy Analysis Matrix (PAM) that relates the above parameters of comparative advantage and policy effects (Masters 1991, Masters and Winter-Nelson 1995, Khan 1997 Khan 2001, Khan 2002 and Khan 2004). This study used the PAM approach to determine international competitiveness of potato farming region Gilgit and policy effects on farmers income. The PAM is a matrix of costs and revenue structures and consists of two accounting identities (Table 1.4). The first identity depicted by second and third column of the matrix shows that profit is equal to revenue minus costs measured in either private or social opportunity costs terms. The second identity shown by last column measures the policy effects i.e.; the difference between observed values and efficiency values.

Table 1.4: The Structure of the Policy Analysis Matrix (PAM)

Budget Items	***Private Budget at Market Prices***	***Budget at National Opportunity Costs***	***Policy Effects (Divergences)***
Revenue	A	F	K^c

Labor costs	B	G	L^d
Capital costs	C	H	M^e
Tradable input costs	D	I	N^f
Profits	E^a	J^b	O^g

Source: Adapted from Ph.D. Thesis of Noor P. Khan Submitted to University of Kentucky, USA, 1997.

[a]*Net Private Profitability, E = A-B-C-D*
[b] *Net Social Profitability, J = F-G-H-I*
[c]*Output Transfers, K = (A - F).*
[d]*Labor Market Distortions L, = (B - G).*
[e]*Capital Market Distortions M, = (C - H).*
[f]*Other inputs Transfers N, = (D - I).*
[g]*Total Policy Effects O, = (E - J) = (K - L - M - N) = (NPP - NSP) = PSE_{Total}.*

Using the elements in Table 1.4, the PAM framework has the flexibility to generate more conventional measures of comparative advantage and indicators of policy effects that are independent of measurement units and scale of operation to facilitate comparisons among different commodities (Monke and Pearson, 1989) which are as followed:

1. *Domestic Resource Costs Ratio (DRC) = (G + H)/(F - I)*
2. *Social Benefit-Cost Ratio (SCB) = F/(G + H + I)*
3. *Nominal Protection Coefficient (NPC) = A/F*
4. *Effective Protection Coefficient (EPC) = (A - D)/(F - I)*
5. *Percentage Producer Subsidy Equivalent (PSE) = O/A*
6. *Subsidy Ratio to Producers(SRP) =O/F*

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 social prices in local currency. In the PAM context, DRC = (G + H)/(F - I). In this ratio, G and H are costs of (non tradable) 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 value added of the activity when everything is valued at social opportunity cost. It shows that DRC less than 1 means that comparative advantage. In simple words minimizing the DRC is thus equivalent to maximizing social profits and vis-à-vis.

The Social Benefit-Cost ratio is another measure of relative and comparative advantage efficiency. In the PAM context, SCB = F/(G + H + I), where F is the revenue both valued at social prices and G, H, I are the costs of tradable and non tradable inputs**.** There is direct relationship between SBC ratio and the measure of comparative advantage. An enterprise with higher SBC (greater than unity) suggests that activity's net social benefits are more than social costs and therefore the enterprise enjoys comparative advantage, while lower SBC (positive but less than unity) implies that it does not has such advantage.

Indicators of policy analysis can be generated directly from the elements in PAM. The simplest indicator of policy analysis is the Nominal Protection Coefficient (NPC), the ratio of domestic to border prices for given product. Using entries in Table 3.4, the ratio, NPC = A/F, is formulated very easily, where A is domestic price and F is border price of a given commodity**.** As an indicator of policy effects, an NPC lower than one means that production of a particular commodity is taxed either because of market failure or government intervention. Conversely, an NPC greater than unity suggests inefficiency of a country in producing that particular commodity and that the price is heavily affected by government policies or other factors.

The EPC can be defined as the ratio of distorted tradable valued added at market prices to its undistorted value priced at border prices. Using PAM elements, EPC = (A - D)/ (F - I). The entries A and D are revenue and tradable inputs costs valued at market prices while the elements F and I are revenue and tradable inputs costs valued at social prices. Thus the ratio of the difference between A and D (distorted tradable value added) and F and I (undistorted tradable value added) is EPC. Using the border price as the reference price, an EPC greater than unity implies price protection and positive incentives to the domestic producer of that commodity while the opposite is true when the EPC is positive but less than unity.

The Producers Subsidy equivalent (PSE) and Subsidy Ratio to Producer (SRP) analysis is used to gauge the government intervention for certain crop. The percentage PSE is defined as the ratio of total PSE to revenue valued at market prices. The ratio, PSE = O/ A, is derived very easily from the matrix, where O is total policy transfers and A is revenue at market price Similarly the SRP uses the same information as percentage PSE, but it has an advantage of being equivalent measure like NPC and EPC. The SRP can be obtained directly from PAM Table 3.4 by picking up the relevant elements of the matrix. In the PAM notation, SRP can be written as SRP=O/F, where O is net policy transfers to producers and F is revenue from the activity valued at social opportunity costs prices. The negative values of PSEs and SRPs indicate overall transfer from producer to consumer and tax payers while the positive values of PSEs and SRPs indicate the overall transfer from consumer to producer.

Results and Discussion

Estimation of PAM Budgets and Underlying Assumptions:

The policy analysis matrix (PAM) is a product of two accounting identities, one defining profitability as the difference between revenues and costs and the other measuring the effects of divergences (distorting policies and market failures) as the difference between

observed values and economic/social values. By filling in the elements of the PAM for an agricultural system, an analyst can measure both the extent of transfers occasioned by the set of policies acting on the system and the inherent economic efficiency of the system. Profits are defined as the difference between total (or per unit) sales revenues and costs of production. This definition generates the first identity of the accounting matrix. In the PAM, profitability is measured horizontally, across the columns of the matrix. Profits are found by the subtraction of costs, from revenues. Each of the column entries is thus a component of the profits identity revenues less costs equals profits.

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

The initial two columns of PAM budgets list the budget items and their total values at market prices. The next column of PAM budgets presents the value of tradable inputs estimated from column two based on the proportion of tradable inputs. The fourth column presents the market values of the budget items. The fifth column contains the opportunity cost values of input and output of budget items that are obtained by multiplying tradable input values in column three with 5 percent foreign exchange premium. The last column of PAM budgets shows any divergence of resources due to market distortions or government policies both in input and output market.

Output:

The per acre potato yield (output) is multiplied by the average wholesale market price to get total revenue for the respective copping zone. The revenue at national opportunity costs values are calculated by multiplying the output by the export parity price at farm gate for export purpose and by import parity price for import substitution. The export parity and import parity prices are given in Tables A.1 and A.2 in the appendix section.

Labour:

In the PAM budgets, labor is the next item listed after output. The shadow price or opportunity cost of labour is simply equal to the marginal value product that is the marginal output of labour forgone elsewhere because of its use in the production of potato. In a perfectly competitive economy, the shadow price of labour would be equal to the wage. The last component of the labor in the PAM budget, the indirect labor, is obtained by adding up the non tradable components of tradable inputs related to potato production activities. the tradable inputs

are estimated and then the non-traded segment of intermediate inputs is divided into labor and capital according to their percentage share in these inputs.

Chemical Fertilizer:

In Pakistan, farmers use both domestically produced and imported fertilizer. Generally, fertilizer is considered tradable input in PAM analysis. However, in this study we assume that market value and opportunity cost value of the fertilizer are the same in the country.

Capital:

The next item in the PAM budget is capital. Capital includes interest, land rental values and capital resources that are used indirectly in potato 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 Gilgit. Indirect capital cost is estimated similar to labor after accounting for tradable inputs and labor costs of intermediate inputs using the proportionate table.

Tradables:

The last input item of PAM budgets is tradable inputs. Tradable are those inputs which can be traded in the international markets are used directly or indirectly in producing and marketing of a crop. This includes the tradable inputs and 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 (FEP) of 5 percent calculated.

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

The DRC analysis measures comparative advantage. It plays the same substitute role for social profits as does the Private Cost Ratio (PCR). Minimizing the DRC is thus equivalent to maximizing social profits. The smaller the national cost incurred on transforming domestic resources to yield a unit of foreign exchange, the more efficiently the country uses its scarce resources. There exists an inverse relationship between DRC and comparative advantage. A country has a comparative advantage in an activity and contributes to national welfare (NSP > 0) if DRC ratio is less than unity. Conversely, a DRC ratio greater than unity suggests the inefficiency of a country in producing that particular commodity (NSP < 0).

Table 1.5: Domestic Resource Costs (DRC) of Potato Production

Agro-ecological Zones	***Import Substitution Regime***	***Export Promotion Regime***
Single cropping Zone	0.27	1.02
Marginal Double Cropping Zone	0.28	1.09

Double Cropping Zone	0.28	1.11

Source: Author's Calculations from PAM Budget in Appendices Table: 1 to 6.

The DRC coefficients shown in Table 1.5 for the three agro-ecological zones in Gilgit are 1.02 for single cropping zone, 1.09 for marginal zone and 1.11 for double cropping zone that confirms the comparative disadvantage in producing potato for export purposes in the study area. The DRC values for the three agro-ecological zones are 0.27 for single cropping zone and 0.28 for marginal and double cropping zone and with a very minor variations, which clearly indicates that all the three agro-ecological zones have comparative advantage for potato production. The DRC analysis further shows that single cropping zone enjoys relatively better comparative advantage than other zones.

Social Benefit Cost (SBC) Analysis: The Measure of Comparative Advantage

The Social Benefit Cost (SBC) ratio is the net social benefits to the social opportunity costs of resources incurred in the production process. It is expressed as SBC = F/(G+H+I), where F is the revenue (social value) and G, H, I are the costs of tradable and non-tradable inputs, all valued at social prices. There is direct relationship between SBC ratio and the measure of comparative advantage. An enterprise with higher SBC (greater than unity) suggests that activity's net social benefits are more than social costs and therefore, the enterprise enjoys comparative advantage, while lower SBC (positive but less than unity) implies that it does not has such advantage.

Table 1.6: Social Benefit Costs Coefficients (SBC) of Potato Production

Agro-ecological Zones	***Import Substitution Regime***	***Export Promotion Regime***
Single Cropping Zone	3.00	0.99
Marginal Double Cropping Zone	2.83	0.94
Double Cropping Zone	2.79	0.93

Source: Author's Calculations from PAM Budget in Appendices Table: 1 to 6.

Table 1.6 shows that SBC ratios for import substitution and export promotion regime in all the three agro-ecological zones. The results show that the SBC ratios for import substitution regime in all the three agro-ecological zones range from 2.79 to 3.00 which are greater than unity which reflects that the area has a comparative advantage in producing potato crop when potato is produce as import substitute. The single cropping zone enjoys relatively a higher comparative advantage than other two zones due to low cost of the tradeables and yield. The SBC ratios for export promotion regime are 0.99 for single cropping zone, 0.94 for marginal cropping zone and 0.93 for double cropping zone. The values are less than unity

which shows the comparative disadvantage of all the three agro-ecological zones. The SBC ratios further explain that single cropping zone has relatively better comparative advantage over other zones for import substitution regime which further supports the results of the DRC as discussed above.

Nominal Protection Coefficient (NPC): The Indicators of Policy Effects

The nominal protection coefficient (NPC) is a ratio that contrasts the observed (market) commodity price with a comparable world (social) price. This ratio indicates the impact of policy that causes a divergence between the two prices. It is the simplest indicator of policy effects. The NPC is simply defined as the ratio of domestic price of commodity to its border price. In the PAM context, NPC = A/F, where A and F are revenues per acre evaluated at domestic and border prices of the commodity respectively. As an indicator of policy effects, an NPC lower than one means that production of a particular commodity is taxed either because of market failure or government intervention. Conversely, an NPC greater than unity suggests inefficiency of a country in producing that particular commodity and that the price is heavily affected by government policies or other factors.

Table 1.7: Nominal Protection Coefficients (NPC) of Potato Production

Agro-Ecological Zones	***Import Substitution Regime***	***Export Promotion Regime***
Single Cropping Zone	0.54	1.61
Marginal Double Cropping Zone	0.56	1.68
Double Cropping Zone	0.59	1.78

Source: Author's Calculations from PAM Budget in Appendices Table: 1 to 6.

Table 1.7 shows that the values of NPC of potato crop production in the three agro-ecological zones in the study area both for import substitution regime and export promotion regime. This indicates that values of NPC for import substitution for the three agro-ecological zones in the study area are 0.54 in single cropping zone, 0.56 in marginal double cropping zone and 0.59 in double cropping zone which are less than unity which implies that potato farmers are receiving prices less than world reference prices. By comparing among the three cropping zones, farmers of the single cropping zone are receiving less than others. While in case of export promotion regime, the NPC value for single cropping zone is 1.61, for marginal cropping zone is 1.68 and 1.78 for double cropping zone. This indicates the farmers in all the three cropping zone are receiving more than the world reference prices due to subsidies provided to the potato farmers by the government.

Effective Protection Coefficient (EPC): The Indicators of Policy Effects

The effective protection coefficient (EPC) is an another indicator of incentives. This coefficient measures the degree of policy transfer from product market output and tradable input policies. The EPC can also be defined as the ratio of distorted tradable valued at market prices to its un-distorted valued at border prices. Using PAM elements, EPC = (A-D)/(F-I). The EPC quickly became and still remains a dominant indicator of policy effects in empirical studies. As such, the EPC is the summary measure of the incentives or disincentives caused by government policies in both input and outputs markets. Using the border price as the reference price, an EPC greater than unity implies price protection and positive incentives to the domestic producer of that commodity while the opposite is true when the EPC is negative but less than unity.

The EPC values given in Table 1.8 indicate that for an import substitution regime, the values are 0.49 for single cropping zone, 0.52 for marginal cropping zone and 0.55 for double cropping zone which are less than unity which show that input and output were taxed showing the disincentives caused by the government policies both at input and output market. The farmers of the

Table 1.8: Effective Protection Coefficient (EPC) of Potato Production

Agro-Ecological Zones	***Import Substitution Regime***	***Export Promotion Regime***
Single Cropping Zone	0.49	1.87
Marginal Double Cropping Zone	0.52	2.01
Double Cropping Zone	0.55	2.18

Source: Author's Calculations from PAM Budget in Appendices *Table: 1 to 6.*

single cropping zone are taxed heavily than the farmers of other two zones. In case of export promotion the EPC values are 1.87 for single cropping zone, 2.01 for marginal cropping zone and 2.18 for double cropping zone which are higher than unity which means that price are protected and positive incentives to the domestic producers in all the three cropping zones.

Producer Subsidy Equivalent (PSE): The Indicators of Policy Effects

Producer subsidy equivalent (PSE) is defined as the difference between private profitability and national profitability as a proportion of private revenue. It is the producer subsidy that would be necessary for removal of array of government farm policies employed in particular country in order to leave farm income unchanged. It is used to reduce state participation in agriculture and liberalize commodity trade. In PAM notion it is expressed by PSE = O/A.

Table 1.9: Producer Subsidy Equivalent (PSE) of Potato Production

Agro-Ecological Zones	*Import Substitution Regime*	*Export Promotion Regime*
Single Cropping Zone	-0.86	0.39
Marginal Double Cropping Zone	-0.78	0.41
Double Cropping Zone	-0.67	0.45

Source: Author's Calculations from PAM Budget in Appendices Table: 1 to 6.

Table 1.9 shows the PSE value for both import substitution regime and export promotion regime in the three agro-ecological zones of Gilgit farming region. In case of import substitution regime, the negative signs of PSE indicate overall transfer from potato producer to consumers and tax payers. The values of PSE analysis further shows the extent of taxation of potato that are 0.86 % for single cropping zones, 0.78% for marginal double cropping zone and 0.67% for double cropping zone. However, production of potato for export promotion needs government positive support to the extent of 0.39% for single cropping zone, 0.41% for marginal double cropping zone and 0.45% for double cropping zone.

Subsidy Ratio to Producers (SRP):

A final incentive indicator is the subsidy ratio to producers (SRP), the net policy transfer as a proportion of total social revenues or SRP = O/F. The SRP shows the proportion of revenues in world prices that would be required if a single subsidy or tax were substituted for the entire set of commodity and macroeconomic policies. The SRP permits comparisons of the extent to which all policy subsidizes agricultural systems. The SRP measure can also be disaggregated into component transfers to show separately the effects of output, input, and factor policies

Table 1.10: Subsidy Ratio to Producer (SRP) of Potato Production

Agro-Ecological Zoness	*Import Substitution Regime*	*Export Promotion Regime*
Single cropping Zone	-0.46	0.62
Marginal Double Cropping Zone	-0.43	0.70
Double Cropping Zone	-0.40	0.80

Source: Author's Calculations from PAM Budget in Appendices Table: 1 to 6.

Table 1.10 shows the SRP value for both import substitution regime and export promotion regime in the Gilgit farming region. In case of import substitution regime the

negative signs of SRP indicate overall transfer from potato producer to consumers and tax payers. The SRP analysis further shows the extent of taxation of potato that are 0.46 % for single cropping zones, 0.43% for marginal double cropping zone and 0.40% for double cropping zone. However production of potato for export promotion needs government positive support to the extent of 0.62% for single cropping zone, 0.70% for marginal double cropping zone and 0.80% for double cropping zone.

Policy Implications of the Study

The results of the study show that potato production is profitable for import substitution for all of the three agro-ecological zones of the district Gilgit but not for export promotion. This is confirmed by the values of Domestic Resource Cost (DRC) ratio and Social Benefit Cost (SBC) ratio in all the three agro-ecological zones. It is also found that single cropping zone in the research area is more competitive than marginal double cropping and double cropping zones for import substitution. The indicators of policy incentives like Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC) show that potato production is encouraged by the policy incentives for the import substitution strategies and not for export promotion strategy. This implies that the current government agricultural and macroeconomic policies are consistent with competitiveness of potato production for import substitution, but are not for export promotion. The analysis further reveals that marketing and transportation, fertilizer, land preparation and land rent were the major cost items in potato production. This study recommends that we can strengthen our competitiveness in potato production for export proportion by improving crop yield through on-farm varietal trials, provision of improved seed and other inputs to farmers and ensuring world level prices to potato growers. Finally, government should launch awareness programme about low labour intensive farm technology, better crop management practices.

Conclusions

The PAM results show that potato crop is highly lucrative enterprise for the all the three agro-ecological zones in the research area. The competitiveness analysis clearly indicates that potato production is nationally profitable for import substitution but are not profitable for export promotion. It is further explains that all the three cropping zones can not produce potato for export purpose under existing agro-climatic and topographic conditions of the area and policies; however this crop can be produced with comparative advantage for food self-sufficiency/ import substitution.

The policy analysis shows that for import substitution regime in all the three agro-ecological zones, the farmers are receiving less than the world prices and also farmers are

taxed both in output and input markets. While, for export promotion, the farmers are receiving more than world reference prices and thus farmers are subsidized both in output and input markets. This implies that the current sets of agricultural and macro-economic policies are not consistent with competitiveness of potato production for both import substitution and export promotion regimes. Since we are competitive in production of potato as import substitution, therefore, both the government and private sectors should subside production in that regime by extending all kinds of financial and infrastructural support. Since we have comparative disadvantage in potato production as export promotion, the government should discourage potato production for export purpose so that the scarce resources may be reallocated to the most efficient use in the research area.

The demand for this food item remains round the years but due to short supply during June-November the price triggers up beyond the reach of the consumers. Pakistan's International trade of Potato (including seeds) lacks stability. As a matter of fact the export of potato is *"surplus based"*. The price of potato over the years is showing a cyclical trend (Fig 1.1), this continuous change in the prices is due to the mismanagement and lack of planning. Sometimes farmers produce the crop in excess as compare to its demand and some times they lag behind. Such fluctuations in supply and its prices put adverse effect on producer as well as consumers. To stabilize the prices in the market especially during off seasons, it is imperative for the researchers, administrators and policy makers in Pakistan to think and reshape the ways and means to assess the countries demand and promote potato production at least for food self-sufficiency/import substitution for food security purpose accordingly.

Recommendations

Some policy suggestions coming out of this study are already spelt out in the text. The most obvious policy recommendation are laid down as follow:

1. The study shows that potato yield is low relative to the other potato growing countries of the world and therefore is recommended that the scientists and policy makers should introduce new high yielding, disease resistant potato verities in the area.

2. The planting material especially seed potato is the key player in higher crop yield. The public sector should formulate a strategy involving the private sector for making easy access to disease free seed potato at affordable prices during the planting season in Northern Areas.

3. The existence of small landholdings and high return to land for potato crops in the area, the farmers do not follow the crop management practices like crop rotation, which hampers the crop yield day by day. The agriculture extension services should be strengthened in the area and train the farmers about the best crop management practice and cropping patterns.

4. Keeping in view the typical geographical location of the area, government should focus its attention to develop and improve physical infrastructure i.e. farm to market roads, transportation, and encourage group or cooperative marketing of inputs and output among the potato farmers.

5. It was realized during this study that there is food policy crisis rather than food crises in Pakistan. A serious and sincere effort is needed on the part of top administrators of country to make agricultural, trade and micro/macroeconomic policies consistent with our food policy objectives to maximize food self-sufficiency and ensure cheaper and safer food to the people of Islamic Republic of Pakistan.

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Appendix Table 1:
PAM Budget of Potato for Single Cropping Zones in Gilgit (Export Promotion Regime) Rupees Per Acre

For Exch Prem 5%* Tradable

Item	*Total Value*	*Percent Tradable*	*Market Value*	*Opportunity Cost Value*	*Transfers*
Product	**106904.66**	**106904.66**	**106904.66**		
Export Parity (2004-05)	63300.24	63300.24	63300.24	**66465.25**	**40439.41**
Labour	**16941.80**		**16941.80**	**16941.80**	**0.00**
Tradables	**48121.56**	**17992.36**	**17992.36**	**18891.98**	**-899.62**
Profitability			**40598.07**	**-740.95**	**41339.02**
DRC				**1.02**	
SBC				**0.99**	
NPC				**1.61**	
EPC				**1.87**	
PSE				**0.39**	
SRP				**0.62**	
Yields (Maunds/acre)	206.30				
Avg Market price (Rupees/40Kgs)	518.20				
Total value of Potato Production	106904.66				
Export Parity price Rs/40 Kgs (2004-2005)	306.84				
Total Value of Export Parity Price	63300.24				

Source: Survey data

Appendix Table 2
PAM Budget of Potato for Marginal Double Cropping Zones in Gilgit (Export Promotion Regime) Rupees Per Acre

For Exch Prem 5%* Tradable

Item	*Total Value*	*Percent Tradable*	*Market Value*	*Opportunity Cost Value*	*Transfers*
Product	**101316.60**	**101316.60**	**101316.60**		
Export Parity (2004-05)	**57378.31**	**57378.31**	**57378.31**	**60247.22**	**41069.38**
Labour	**16178.58**		**16178.58**	**16178.58**	**0.00**
Capital	**29003.78**		**29003.78**	**29003.78**	**0.00**
Tradables	**44684.85**	**17764.43**	**17764.43**	**18652.65**	**-888.22**
Profitability			**38369.81**	**-3587.78**	**41957.60**
DRC				**1.09**	
SBC				**0.94**	
NPC				**1.68**	
EPC				**2.01**	
PSE				**0.41**	
SRP				**0.70**	
Yields (Maunds/acre)	187.00				
Avg Market price (Rupees/40Kgs)	541.80				
Total value of Potato Production	101316.60				
Exp Parity price Rs/40 Kgs (2004-2005)	306.84				
Total Value of Export Parity Price	57378.31				

Source: Survey data

Appendix Table 3:
PAM Budget of Potato for Double Cropping Zone in Gilgit
(Export Promotion Regime Rupees Per Acre)

For Exch Prem 5%* Tradable

Item	*Total Value*	*Percent Tradable*	*Market Value*	*Opportunity Cost Value*	*Transfers*
Product	**104271.75**	**104271.75**	**104271.75**		
Export Parity (2004-05)	**55690.71**	**55690.71**	**55690.71**	**58475.25**	**45796.50**
Labour	**15995.87**		**15995.87**	**15995.87**	**0.00**
Capital	**27994.06**		**27994.06**	**27994.06**	**0.00**
Tradables	**43349.98**	**17905.28**	**17905.28**	**18800.55**	**-895.26**
Profitability			**42376.54**	**-4315.23**	**46691.77**
DRC				1.11	
SBC				0.93	
NPC				1.78	
EPC				2.18	
PSE				0.45	
SRP				0.80	
Yields (Maunds/acre)	181.50				
Avg Market price (Rupees/40Kgs)	574.50				
Gross Value of Potato Production	104271.75				
Exp Parity price Rs/40 Kgs (2004-2005)	306.84				
Total Value of Export Parity Price	55690.71				

Source: Survey data

Appendix Table 4:
PAM Budget of Potato for Single Cropping Zone in Gilgit
(Import Substitution Regime) Rupees Per Acre)

For Exch Prem 5%* Tradables

Item	*Total Value*	*Percent Tradable*	*Market Value*	*Opportunity Cost Value*	*Transfers*
Product	**106904.66**	**106904.66**	**106904.66**		
Import Parity (2004-05)	**189947.84**	**189947.8368**	**189947.8368**	**199445.2286**	**-92540.57**
Labour	**16941.80**		**16941.80**	**16941.80**	**0.00**
Capital	**31372.42**		**31372.42**	**31372.42**	**0.00**
Tradables	**48121.56**	**17992.36**	**17992.36**	**18891.98**	**-899.62**
Profitability			**40598.07**	**132239.02**	**-91640.95**
DRC				0.27	
SBC				3.0	
NPC				0.54	
EPC				0.49	
PSE				-0.86	
SRP				-0.46	
Yields (Maunds/acre)	206.30				
Avg Market price (Rupees/40Kgs)	518.20				
Gross Value of Potato Production	106904.66				
Import Parity Price Rs/40 Kgs (2004-2005)	920.74				
Total Value of Import Parity Price	189947.84				

Source: Survey data

Appendix Table 5:
PAM Budget of Potato for Marginal Double Cropping Zone in Gilgit
(Import Substitution Regime Rupees Per Acre)

For Exch Prem 5%* Tradables

Item	*Total Value*	*Percent Tradable*	*Market Value*	*Opportunity Cost Value*	*Transfers*
Product	**101316.6**	**101316.6**	**101316.6**		
Export Parity (2004-05)	172177.63	172177.63	172177.63	180786.51	**-79469.91**
Labour	**16178.58**		**16178.58**	**16178.58**	**0.00**
Capital	**29003.78**		**29003.78**	**29003.78**	**0.00**
Tradables	**44684.85**	**17764.43**	**17764.43**	**18652.65**	**-888.22**
Profitability			**38369.81**	**116951.51**	**-78581.69**
DRC				0.28	
SBC				2.83	
NPC				0.56	
EPC				0.52	
PSE				-0.78	
SRP				-0.43	
Yields (Maunds/acre)	187.00				
Avg Market price (Rupees/40Kgs)	541.80				
Gross Value of Potato Production	106904.66				
Exp Parity price Rs/40 Kgs (2004-2005)	920.74				
Total Value of Import Parity Price	172177.63				

Source: Survey data

Appendix Table 6
PAM Budget of Potato for Double Cropping Zone in Gilgit
(Import Substitution Regime Rupees Per Acre)

For Exch Prem 5%* Tradables

Item	*Total Value*	*Percent Tradable*	*Market Value*	*Opportunity Cost Value*	*Transfers*
Product	**104271.75**	**104271.75**	**104271.75**		
Export Parity (2004-05)	167113.58	167113.58	167113.58	**175469.26**	**-71197.51**
Labour	**15995.87**		**15995.87**	**15995.87**	**0.00**
Capital	**27994.06**		**27994.06**	**27994.06**	**0.00**
Tradables	**43349.98**	**17905.28**	**17905.28**	**18800.55**	**-895.26**
Profitability			**42376.54**	**112678.79**	**-70302.25**
DRC				0.28	
SBC				2.79	
NPC				0.59	
EPC				0.55	
PSE				-0.67	
SRP				-0.40	
Yields (Maunds/acre)	181.50				
Avg Market price (Rupees/40Kgs)	574.50				
Gross Value of potato Production	104271.75				
Export Parity price Rs/40 Kgs (2004-2005)	920.74				
Total Value of Import Parity Price	167113.58				

Source: Survey data