Cost-benefit Analysis of CFPR

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Abstract

This paper presents a cost-benefit analysis of the first cohort (2002-03) of selected ultra poor (SUP) households of BRAC's CFPR. The analysis calculates benefit of the programme using primary data collected through a set of surveys. Benefit is measured as the increase in expenditure on food consumption, increase in medical expenses and/or income foregone from workdays lost as a result of an increase in the (financial) capacity to take such decisions, and increase in net financial and housing assets of the SUP households compared to not selected ultra poor (NSUP) households. As the social worth of improved expenditure is higher for poorer households, different social weights have been assigned to the benefit accrued by different sub-categories of households. Households were categorized on the basis of either per capita income or per capita energy consumption of SUP households in 2002. An alternative calculation of benefit has also been carried out by comparing the increase in per capita income of SUP households with that of NSUP households. Using the consumption indicators it has been found that at a 12% discount rate and a 12-year life of benefits, the benefit-cost (B-C) ratio is 5.07, while using the income method the B-C ratio is 3.83. Sensitivity analysis of the B-C ratio using consumption indicators shows that within a reasonable range of assumptions from relatively pessimistic to reasonably optimistic the B-C ratio lies in the range 3.12-6.23 allowing for discount rates of 10 to 15% and the life of benefits in the range of 10-15 years. The analysis shows that the special investment programme of CFPR represents productive use of development funds for the benefit of ultra poor households in Bangladesh with obvious implications for additional investment.

Introduction

BRAC's Challenging the Frontiers of Poverty Reduction (CFPR) was initiated in 2002 to enable the ultra poor of Bangladesh to undertake mainstream economic activities that would generate sustainable incomes to lift them out of poverty. The rationale of the CFPR lies in the recognition that the widely available microfinance programmes have failed to address the needs of the ultra poor, either because such people are excluded from these programmes or because they lack the human and physical capital required for the productive use of microfinance. Thus, the Poverty Reduction Strategy Paper (PRSP) noted that micro-credit alone cannot address the extreme poverty of Bangladesh, "the extreme poor must be reached with micro-credit through innovative approaches with respect to changes in credit delivery mechanism, diversified financial services and complementing micro-finance with non-financial interventions" (IMF 2005, pp. 101). BRAC's CFPR aims to improve the lives of the ultra poor through a combination of asset transfer, supplementary feeding, and livelihood support services as well as social awareness and other welfare activities.

The first phase of the CFPR (2002-06) included 100,000 ultra poor households who were selected through a rigorous process. The households were ranked into different wealth categories through Participatory Rural Appraisal (PRA) technique and the households from the bottom category were checked for specific selection criteria in household visits. The programme appears to have been largely successful in addressing the livelihood constraints of the ultra poor. This is apparent from a number of studies conducted to evaluate the programme (Rabbani *et al* 2006, Haseen 2006). As a result, the programme has attracted attention as an innovative means of addressing the needs of the ultra poor. However, the comprehensive packages of the programme make it relatively costly and hence the success needs to be evaluated according to its cost.

This study undertakes a cost-benefit analysis for the first cohort (2002-03) of the first phase of the CFPR to determine whether the programme represents a replicable model for the graduation of the ultra poor to mainstream development activities.

Methods

Data

For the cost-benefit analysis, information on programme costs has been obtained from BRAC's Accounts Department while for estimating the benefits we used the primary data collected through surveys for impact evaluation. Three rounds of nutrition survey were conducted during June-July 2002 (baseline), June-July 2004 (follow up) and June-July 2006 (follow up). These nutrition surveys were conducted on the same 180 selected ultra poor (SUP) households who received programme support in 2002 and 193 not selected ultra poor (NSUP) households from the same locality for comparison.[1] The NSUP are those households who were ranked as ultra poor in the PRA but failed to meet the final selection criteria. Another set of impact surveys was conducted during June-August 2002 (baseline) and September-October 2005 (follow up) covering 2,375 SUP households and 2,692 NSUP households.[2]

These surveys provide information on the following indicators:

Food: Food consumption and the resulting energy intake on a per capita basis and food security (in terms of regularity of food availability).

Health: The number of productive days lost due to illness, the duration of each incidence of illness, medical expenses incurred for the ailments, and water and sanitation conditions.

Household income: Per capita income

Assets: Land ownership, household assets (furniture, bicycles, radio/television, tubewells for water), and productive assets (cattle, poultry, rickshaws/vans, etc.).

Demography and education: Household size, dependency ratio, literacy rate and school enrolment of children.

[1] For more details about the surveys see Haseen (2006).
[2] For more details about the surveys see Rabbani *et. al*. (2006).

Financial status: Cash savings and savings withdrawal; credit market participation (loans taken as well as given); and purpose of borrowing.

House: Housing status and investment in homestead improvements.

Social assets: Legal awareness; social inclusion; and festival (Eid) spending.

Other activities of the programme: Such as effectiveness of the village poverty eradication committees.

The indicators that are relatively easy to monetize include food consumption, health, income and assets. All of these have been used for this analysis. We have not included education as an indicator of benefit since it is likely to cause double counting in relation to income. Information on financial and housing status has been converted into benefit indicators.

Information on social assets and other activities like village committees is useful (and may even be classified as a benefit) but it is far more difficult to monetize these as benefits for comparison with cost. Due to this difficulty, these indicators have not been used for the cost-benefit analysis carried out in this study.

In addition to the information from the above-mentioned surveys, CFPR progress reports, periodic reviews of CFPR and the annual monitoring review contain valuable quantitative and qualitative information on the outputs of the programme. However, due to the lack of specific measures on pre- and post-programme situation, it is impossible to quantify (and monetize) benefits resulting from some of these other social outputs. However, Annex 1 lists some of these.

Benefit calculation

As mentioned above, estimates of benefits have been derived from (i) food consumption, (ii) health and freedom of choice in determining the pattern of expenditure, (iii) income, (iv) financial status – savings, borrowing and lending, (v) assets – productive assets, and (vi) housing improvements.

These indicators can be divided into components of consumption and income. As benefits of the programme, these components have overlapping effects and must be carefully separated to avoid double counting. Such a separation can be done based on the following equation:

Increase in income = Increase in [consumption + saving /investment]

More precisely, using the above indicators, this equation becomes:

[Income from increased productive assets] + [Income from increased financial assets] + [Income from improved literacy and/or education] = [Increase in expenditure on food consumption] + [Increase in health expenditure] + [Increase in other expenses] + [Increase in savings] + [Increase in investments: financial (lending to others) + housing] – [Increase in loans and/or other liabilities]

Expenditure on food consumption

Benefit per household has been measured as the difference between an increase in the expenditure on food by SUP and NSUP households. Information on food consumption was collected by measuring food intake over a 24 hour-period, with a 3-day recall of food intake, and frequency of food consumption in each household over the last seven days. The averages obtained were converted to caloric value using common nutrient tables.

If the individuals are already well-nourished, additional expenditure on food may not result in nutritional improvement. However, in our analysis, all additional food expenditure of the SUP has been assumed to be a benefit regardless of the nature of the food consumed. This is because households included in the survey range from near-starvation and severely under-nourished to the borderline of adequately nourished. The vast majority were under-nourished with 73% of the SUP below nutritional level of 2,122 kcal per capita per day in 2002. At this level of existence, any additional nourishment available to a person supplements their energy levels and contributes to their ability to survive and improve their productivity. None of the food is surplus to requirements even if it could be argued that a different pattern of expenditure would have been more efficient in improving their nutritional status.[3]

Calculation

1. Food expenditure per household has been estimated for both SUP and NSUP in 2002, 2004 and 2006:
   Total food consumption per household = per person food consumption × average household size

   Food expenditure per household (FE) = Total food consumption per household × price/unit[4]

[3] However, since information on the intra-household distribution of food is not available, this aspect of the question of benefit has been ignored in this study.
[4] Retail price collected from Bangladesh Bureau of Statistics (BBS).

2. Calculation of the difference in improvement between SUP and NSUP for 2002, 2004 and 2006:
   Difference = $FE^{SUP} - FE^{NSUP}$
3. Overall programme benefit from 2002 to 2004 on nutrition
   = (Difference ^{2004} – Difference ^{2002}) × 5,000 (total households in the first cohort)
   Overall programme benefit from 2002 to 2006 on nutrition
   = (Difference ^{2006} – Difference ^{2002}) × 5,000

Benefit in the form of improved nutrition is analyzed based on four different sub-categories of households. The sample households were categorized based on their per capita energy consumption in 2002 (Table 1).[5] Different social weights have been assigned to the nutritional benefit accrued to different sub-categories of households with the assumption that the social worth of improved consumption is higher for poorer households.

Table 1. Household categories based on different energy consumption level

Energy consumption (kcal) (per person per day)	Classification	% of total SUP households surveyed in 2002
<1,600	Destitute	41.04
1,600-1,800	Ultra poor	7.51
1,800-2,122	Poor	24.28
>2,122	Not so poor	27.17

Weights have been calculated using the following formula:

$W = (b/c)^e$

where,
W = weight (or the elasticity of the marginal utility of consumption with respect to consumption)
b = critical (or minimum acceptable) consumption level
c = weighted average consumption in each sub-category
e = social value
e = 0 implies that society is value neutral, placing no additional value on the additional consumption achieved
e = 1 implies that the additional value placed by society on additional consumption by households at different poverty levels is directly proportional to the status of the group relative to the critical consumption level

[5] Consumption expenditure could be used to categorize the households. However, food quantities are much more accurately measured than consumption expenditure. For this reason, households were categorized based on energy consumption.

e>1 indicates increasing levels of value placed by society on consumption by relatively poorer households.

For the calculation of weights, the critical consumption level has been used as 2,122 kcal per person per day. Weights have been calculated at e=0, 0.5, 1, 1.5, 2 and 2.5 as shown in Table 2:

Table 2. Social weights for different sub-categories of households

Social value, e=	Sub-categories for per day energy consumption (kcal)			
	<1,600	1,600-1,800	1,800-2,122	>2,122
2.5	5.12	1.77	1.20	0.69
2.0	3.70	1.58	1.15	0.74
1.5	2.67	1.41	1.11	0.80
1.0	1.92	1.26	1.07	0.86
0.5	1.39	1.12	1.04	0.93
0.0	1.00	1.00	1.00	1.00

The consumption items have been categorized into seven groups: cereals, pulses, oil, fish, vegetables, fruits, and animal protein. The price of coarse rice has been used for cereals, *khesari* for pulses, *ruhi* for fish, potatoes for vegetables, bananas for fruit, soybean for oil and beef for animal protein. Price of chicken could be used for animal protein. However, we preferred using price of beef over price of chicken for two basic reasons. Firstly, for SUP households beef is the main meat item. For example, 2004 nutrition survey data shows that 38% of the meat consumed by SUP households was beef, 21% chicken, 24% duck and 17% others. Secondly, if we used chicken price we would have had to make a choice between prices of hybrid and indigenous chicken. Programme benefits have been monetized at 2004 constant prices.[6] To monetize the nutrition benefits at 2004 constant prices, the rural consumer price index (food) has been used. The rate of food price inflation was 13.4% from June 2002 to July 2004 and 16.9% from June 2004 to July 2006.[7]

Health and freedom of choice

Health benefit per household has been calculated based on total workdays lost due to illness and medical expenditure incurred. An increase in workdays lost reflects the ability of the household to take leave and forego earnings when morbidity occurs. On the other hand, improved health status is expected to lead to a reduction in the number of workdays lost due to morbidity. Therefore, this

[6] While monetizing the different types of benefits at constant price, instead of using a common price index, different price indices were used.

[7] Collected from Bangladesh Bureau of Statistics (BBS).

increase reflects not an improvement in health but the greater freedom to make a choice for the welfare of wage earners in the household (Prakash and Rana 2006, Ahmed and Rana 2005).

Similarly, health improvement might be expected to lead to reduction in medical expenditure. For poor people an increase in medical expenditure could be presumed to reflect the improved capacity of a household to spend on better medical services. Since increased medical expenditure is likely to result in at least a partial impact on health, this could be partly attributed to health and partly to greater freedom of choice. Benefit has been measured as the difference in expenditure on medical services between SUP and NSUP households.

If the health benefit had resulted in reduction in the number of workdays lost and reduction in medical expenditure, it could be argued that this was a spillover of the food consumption benefit. Better nutrition resulting from higher food consumption had led to lower vulnerability to ill-health. Since the effect has been a greater freedom to take time off for illness and to spend on better health, the two benefits are taken to be complementary rather than overlapping. According to the survey information, the improved consumption level of both SUP and NSUP households has not led to a reduction in illness/workdays lost over the 3 year period. This suggests that local contextual/environmental factors have had a role to play here, independent of the impact of CFPR.

The survey data show reduction in the duration of illness but this has not been enumerated in this study. A reduction in duration of illness is an indication of improved health status of the household. However, such a change could be attributed to a combination of improvement in nutrition and increased medical expenditure. Enumerating this separately would, therefore, result in double counting with the food consumption and medical expenditure benefits. The information in the surveys indicates a reduction in the duration of illness reported by SUP households from nearly 11 days to under 8 days per episode, while there is virtually no difference in this reduction for the control group of NSUP households. Including this would, therefore, make little difference to the overall calculation of the benefit-cost (B-C) ratio.

Calculation

1. Health benefit has been estimated from the cost of lost productive days and medical expenditure for both SUP and NSUP in 2002 and 2005:
   Cost of lost productive days = workdays lost per household per 15days × 24 × wage rate per day[8]

[8] Wage data were obtained from Sen and Hulme (2006)

Medical expenditure = Medical expenditure per household per 15 days × 24 (fortnights in a year)

Health expenditure (HE)/household = Cost of lost productive days + medical expenditure

2. Calculation of difference in improvement between SUP and NSUP for both 2002 and 2005:
   Difference = $HE^{SUP} - HE^{NSUP}$
3. Overall programme benefit from 2002 to 2005 on health
   = (Difference ^{2005} – Difference ^{2002}) × 5,000

Benefit in the form of improved health is analyzed based on three different sub-categories of households. The sample households surveyed in 2002 and 2005 were disaggregated based on their annual per capita income in 2002. In practice, for comparisons across countries, income of dollar-a-day per person is considered as the cut-off for extreme poverty. At 2002 prices, the value of a dollar in purchasing power parity (PPP) is Tk. 21.60 or Tk. 7,880 per annum.[9] The amount of Tk. 1,970 (25% of the dollar-a-day level) has been used here as a benchmark for ultra poverty and Table 3 demonstrates the three sub-categories.

Table 3. Household categories based on per capita income

Per capita income (Tk.)	Classification	% of total SUP households surveyed in 2002
<1,970	Ultra poor	52.2%
1,970-3,940	Poor	36.3%
>3,940	Not so poor	11.4%

Different social weights have been assigned to health benefit accrued to different sub-categories of households based on the earlier assumption that the social worth of improved expenditure on health is higher for poorer households. Social weights have been assigned using the same formula as for food consumption. For calculating the social weights, the critical per capita income level has been taken at Tk. 3,940 per annum (half of the dollar-a-day level). Income data have been used to determine the critical consumption level since medical expenditure is available for households by per capita income levels but not by consumption levels. For households living on the margins of subsistence a rough equivalence between income and consumption levels seems reasonable. Weights have been calculated at e = 0, 0.5, 1, 1.5, 2 and 2.5 as shown in Table 4.

There are seasonality issues in this calculation of health expenditure. The repeat survey conducted in September-October 2005 is likely to have overstated, to

[9] See the Small Enterprise Education and Promotion (SEEP) (2003)

some extent, the annual figures of health expenses since this is a period (towards the end of the monsoon) of relatively high morbidity in Bangladesh (and elsewhere in South Asia). The survey collected information on workdays lost and healthcare expenditure by 15-day recall from the date of survey. In the absence of more seasonal information, the survey results have been annualized by multiplying the figures by 24.

Table 4. Social weights for different sub-categories of households

Social value, e=	Sub-categories for annual per capita income (Tk.)		
	<1,970	1,970-3,940	>3,940
2.5	21.27	2.74	0.40
2.0	11.54	2.24	0.48
1.5	6.26	1.83	0.58
1.0	3.40	1.50	0.69
0.5	1.84	1.22	0.83
0.0	1.00	1.00	1.00

Programme benefits have been monetized at 2004 constant prices. To monetize the health benefit at 2004 constant price, the rural medical care and health expense price index was used. The rural medical care and health expense inflation rate was 15.5% from June 2002 to July 2004 and 5.0% from July 2004 to September 2005.[10]

Change in financial assets and liabilities, and improvements in housing

The change in financial assets has been enumerated as the change in savings[11] and lending by SUP households relative to NSUP households. Liabilities have been enumerated as the change in borrowing of the SUP households compared to NSUP households. Improvements in housing have been added to the change in financial assets. Physical assets have been excluded from this calculation since – for the participant households – a large proportion of such assets have been provided by the programme. These assets enable participant households to generate additional income to realize the consumption benefit that has already been included. Including these assets in the calculation would result in double counting, unless the assets were acquired through direct purchase by the surveyed households. However, such detail information was not available though excluding those can result underestimation of benefits.

[10] Collected from BBS.

[11] The surveys include information whether the households had savings or not. However, no information was available on the amount of savings. However, amount of savings was assumed to be Tk. 250 per year for each SUP and NSUP household who reported to have savings in 2002 and 2005.

The change in assets is very small compared to the benefits derived from food consumption and health expenditure. Therefore, no attempt has been made to divide the households into sub-categories and all the households have been treated as a single category. Thus, the stream of benefits has been calculated by multiplying the proportion of people with increased assets by the average value of increased assets.

Medical expenditure was assumed to be a proxy indicator of the ability of ultra poor households to make additional choices in expenditure – whether on medical expenditure, financial assets or improved housing. Therefore, to monetize the benefit at 2004 constant prices, rural medical expenses and healthcare price index was used. As mentioned earlier, the rural medical care and health expense inflation rate was 15.5% from June 2002 to July 2004 and 5.0% from July 2004 to September 2005.

Income

Using income as the main indicator of benefit, an alternative B-C ratio has been calculated to cross-check the consumption based estimates. Since the total income of the surveyed households has been measured here, we assume that it includes income from financial assets, education and productive assets. The methodology used for the calculation of benefit is similar to that set out for food consumption, medical expenses and financial assets earlier. The difference in the per capita income of SUP households relative to that of NSUP households at the time of the baseline survey in 2002 is compared to the relative per capita incomes of these two groups at the time of the repeat survey in 2005.

Calculation

1. Estimation of income per household for both SUP and NSUP in 2002 and 2005
   Total income (Y) = Per capita income × average household size

2. Calculation of difference between SUP and NSUP for both 2002 and 2005
   Difference = $Y^{SUP} - Y^{NSUP}$

3. Measuring the overall programme benefit from 2002 to 2005
   Income benefit = (Difference ^{2005} – Difference^{2002}) × 5,000

Income benefit has been calculated for three sub-categories of households based on per capita income in 2002 and then different social weights have been assigned. The method of categorization of households is the same as in the case of the health benefit calculation. Weights have been calculated at e = 0, 0.5, 1, 1.5, 2 and 2.5.

Programme benefits have been monetized at 2004 constant prices. To monetize the income benefits at 2004 constant price, the rural consumer price index was used. The rural inflation rate was 12.0% from June 2002 to July 2004 and 10.7% from July 2004 to September 2005.[12]

Costs

The costs include direct and indirect costs. Broad cost categories under direct and indirect costs are as follows:

Direct costs

1. Special investment (assets transferred to SUP)
2. Enterprise development training
3. Social development for SUP
4. Healthcare subsidy for SUP
5. Contingency

Indirect costs

1. Social development programme (general)
2. Healthcare services (general)
3. Research and evaluation

Programme costs are monetized at 2004 constant prices. To monetize the programme costs at constant prices, the rural consumer price index was used. The rural inflation rate was 12.8% during 2002/03 to 2004/05 and 6.6% during 2003/04 to 2004/05.[13] Indirect costs for the overall social development programme and healthcare services have been allocated based on the proportion of SUP beneficiaries to overall beneficiaries of CFPR (5,000 SUP, 10,000 BDP ultra poor and 258,500 IGVGD (Income Generation for Vulnerable Group Development)). This assumes that the cost-sharing is based on the client numbers. Moreover, 60% of research and evaluation expenses have been allocated to SUP. BRAC's Research and Evaluation Division (RED) devotes around 60% of the time allocated for CFPR to the Special Investment Programme (SIP) under study here.

[12] Collected from BBS.
[13] Collected from BBS.

Results and discussion

Besides the indicators of cost and benefits, there are several other key issues that need clarification and discussion. These include the expected life of the benefits, the stream of long-term benefits and discount rates. In the base case analysis, the life of the benefit is assumed to be 12 years and a discount rate of 12% has been used to calculate the present value of the streams of benefits.[14] In other words, it was assumed that the benefit would sustain for 12 years (2002 to 2013). However, in the sensitivity analysis, the life of benefits has been taken in the range of 10-15 years, and discount rates in the range of 8-15%. In the base case analysis, social weights have been assigned at e=2. However, in the sensitivity analysis value of e has been varied from 0 to 2.5.

For nutrition benefit calculation we have data for 2002, 2004 and 2006 while for health and financial assets benefit calculation we have data for 2002 and 2005. So we would be able to calculate nutrition benefits for 2004 and 2006, and health and financial benefits for 2005 based on survey data. Thus, to obtain the lifetime benefits we need to make some assumptions.

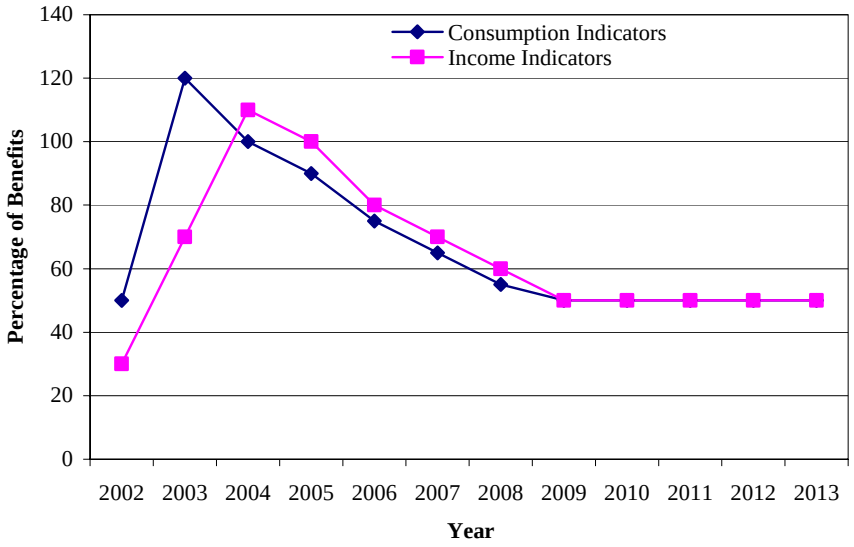
The nutrition/consumption repeat surveys were undertaken in 2004 and 2006 after the asset transfer/subsidy programme ended for the first cohort. The calculation of benefits shows that the nutrition benefit (weighted average for the bottom three sub-categories of households) in 2006 over 2002 was about 75% of that in 2004 over 2002. Furthermore, the nutrition benefit for the top category of households (not so poor) in 2006 over 2002 was 153% of the benefit in 2004 over 2002. Thus, the nutrition benefit in 2006 for each of the bottom three sub-categories of households has been taken to be 75% of the benefit in 2004, and for 2005, a gentler reduction is assumed (Fig.1). More specifically, nutrition benefit in 2005 has been assumed to be 90% of the benefit in 2004. For these three sub-categories, the proportions of nutrition benefits in 2007 and 2008 have been assumed to be 65% and 55% respectively, a gentler reduction from 2006. Similar proportions have been assumed for health benefit calculation of all sub-categories

[14] The discount rate used for the base case, 12% is the same as that recommended by Greeley (2005) but the period of benefits has been reduced to 12 years from the 15 years suggested in the paper. It is highly unlikely that benefits would continue for 15 years in the case of households at this (lowest) level of the income scale.

of households. However, nutrition benefit (per year) for the top category of households (not so poor) in 2006 and the following years is assumed to be 150% of the benefit of 2004, while for 2005 the proportion is taken as 130%.

In the case of nutrition benefit (for the bottom three sub-categories) and health benefits (for all sub-categories), the long-term benefit (i.e. in 2009 and following years) per year has been assumed to be 50% of the benefit in 2004. This is, of course, a relatively conservative assumption.[15] The assumption is a guesstimate. No information is available to verify this level of long-term gain. It is evident that the poorest households will not be able to consume – or earn – in the long-term at the level that direct programme hand-outs make possible in the peak year of the programme. Given the consumption pressures on poor households it is unlikely that re-investment by SIP beneficiaries will take place at the level necessary to protect their peak year consumption gains. Thus 50% appears to be a reasonable (and safe) figure for long-term benefit. Some of the consumption pressures – such as for health and education – entail consumption and investment at the same time. The appropriate rate of long-term benefits is debatable. For this reason in the sensitivity analysis, both a more optimistic level of long-term benefits at the rate of 60% and a highly pessimistic level at the rate of 30% have been used.

Figure 1. Levels of benefit assumed for the reference period (base case)



[15] As implied by Greeley (2006).

The assets benefits in the initial three years of the programme (2002, 2003 and 2004) have been assumed in the proportions of 45%, 90% and 100% respectively assuming 2005 to be 90%. Distribution of the early period benefit assumes that the benefit would be 90% in the second year of direct support by CFPR. The benefits would increase to some extent in 2004 but decline after that. The detailed methodology for determining the long-term benefits is given in Annex 2.

In the case of alternative calculation of benefit using the income indicator, the peak is in 2004. This is based on the assumption that in 2004 the asset transfer starts to yield a full income. The long-term increase in income is assumed to be 50% each year. Assumptions for the income benefits realized by selected households are presented in Figure 1. It shows that benefit declines gradually over the first few years after the end of direct support under the programme and then stabilize from year 2009.

Benefit-cost ratio using consumption indicators (base case)

Annex 3 shows the nutrition benefit calculation for different sub-categories of households in 2004 and 2006. The results show a substantial increase in food expenditure by SUP households between 2002 and 2004 and between 2002 and 2006. For the bottom sub-category of SUP households (destitute households), average annual food expenditure per household increased from Tk. 8,004 in 2002 to an estimated Tk. 23,608 in 2004 resulting in an average relative increase of 93% (after allowing for changes in expenditure by NSUP households). It is also interesting to note that for the bottom sub-category of SUP households, expenditure per household on fruit, fish and animal protein has increased from Tk. 62, Tk. 1217, and Tk. 899 in 2002 to Tk. 1099, Tk. 3904 and Tk. 6181 in 2004 respectively. Given the well-known high income elasticity of demand for such foods in the consumption basket of poor households this is perhaps not surprising.

However, it appears that in 2004 nutrition benefits accruing to the four sub-categories of households (destitute, ultra poor, poor and not so poor) were Tk. 56.33 million, Tk 5.93 million, Tk. 15.25 million and Tk. 9.38 million respectively. The corresponding figures in 2006 were Tk. 39.35 million, Tk. 4.37 million, Tk. 12.42 million and Tk. 14.36 million. The benefit calculation for 2004 and the assumption made about the streams of benefits as mentioned earlier have been used to estimate a series of benefits for each sub-category of households from 2002 to 2013 (12 years). This is shown in Annex 7A. The present value of the streams of nutrition benefits at 12% discount rate for the 5,000 households (households covered in the first cohort) was found to be Tk. 591.82 million while the present value of programme costs was Tk. 158.56 million. The nutrition benefit-cost ratio is thus 3.73.

Annex 4 shows health benefit calculation for 2005. It appears that health benefits for the three sub-categories of households, i.e. ultra poor, poor and not so poor, were Tk. 24.41 million, Tk. 7.33 million, and Tk. (-)0.08 million respectively. Based on the health benefit calculation in 2005 and assumptions made on the streams of benefits, a series of health benefits for each sub-category of households has been estimated for the period 2002 to 2013 (Annex 7A). The present value of the series of health benefits at a discount rate of 12% for 5000 households is Tk. 222.70 million. This results in a health benefit-cost ratio of 1.40.

The asset benefit calculation for 2005 is shown in Annex 5. The asset benefit was found to be negative (Tk. (-) 1.41 million). This is mainly because of an increase in borrowing of the SUP households compared to the NSUP households. Since loans taken by the participants have increased substantially and the increase in loans given plus savings estimated is not as high, this results in negative benefits. Whether or not this should be seen as a counter-intuitive benefit is a moot point. It could be argued that a net dis-saving of this type is evidence of a reduced subjective assessment of vulnerability and greater opportunity as well as increased willingness to take risk. It is only more detailed information on the nature of the loans and their use for production rather than consumption that would enable this matter to be resolved. However, the present value of the series of asset benefit is Tk. (-) 9.29 million (Annex 7A). The asset benefit-cost ratio is (-) 0.06.

The present value of total benefits (nutrition, health and asset benefits) was Tk. 805.23 million (Annex 7A). This results in a B-C ratio of 5.07 with internal rate of return of 76%. This result indicates that the special investment programme is highly cost-effective.

Benefit-cost ratio using the income indicator

Benefit calculation using income indicator is presented in Annex 6. Benefits in 2005 for three sub-categories of households, i.e. ultra poor, poor and not so poor, were Tk. 91.97 million, Tk. 11.00 million and Tk. 1.45 million respectively. Based on the benefit calculation in 2005 and assumptions made on the streams of benefits, a series of benefits for each sub-category of households has been estimated for the period 2002 to 2013 (Annex 7B). The present value of the series of income benefit at 12% discount rate for 5,000 households is Tk. 607.33 million. The B-C ratio is 3.83 at a social value of 2. However, the problem with this calculation is the quality of the data. Income data from surveys are well known to be unreliable as a measure of benefit since respondents are most likely to under-report with a hope that they could derive further benefit from continuing to be seen as ultra poor. Therefore, this alternative income-based calculation should be seen as a secondary result, setting perhaps a lower limit on the B-C ratio for the programme.

Sensitivity analysis

A sensitivity analysis of variations in output (B-C ratios) to changes in the input variables – discount rates, future realization of benefits and social weights – is presented in Annex 8. Not surprisingly, the B-C ratio is most sensitive to social value (e). For an increase in social value (e) the B-C ratio increases. This is mainly because for an increase in value of e higher weight is assigned to the nutrition benefits accrued by bottom three categories of households and health benefits accrued by the bottom two categories of households. As shown earlier, the bottom three categories of households created on the basis of energy consumption include 73% of all sample households while the bottom two categories of household created on the basis of per capita income include 89% of all sample households. However, B-C ratio is also affected by the choice of the discount rates (8%, 10%, 12% or 15%) and the long-term stream of benefits (60%, 50% or 30%). It is less sensitive but still affected by the life of the benefit (15 years, 12 years or 10 years).

Some cases of the sensitivity analysis, ranging from optimistic to pessimistic are presented in Figure 2 and Table 5. Within a reasonable range of assumptions from relatively pessimistic (P3) to reasonably optimistic (O3), the B-C ratio for the programme lies in the range of 3.12 to 6.23 allowing for discount rates of 10-15%, the life of the benefit in the 10-15 years range, social values of 1.5-2.0, and a stream of long-term benefits of around 50-60% of those emerging from the survey results. The internal rate of return for P3 to O3 cases lies in the range of between 52% and 76%. At the extreme, the range for the B-C ratio stretches from 2.20 at the most pessimistic to 9.98 under the most optimistic assumptions.

Figure 2. Benefit-cost ratios emerging from the sensitivity analysis (selected cases)

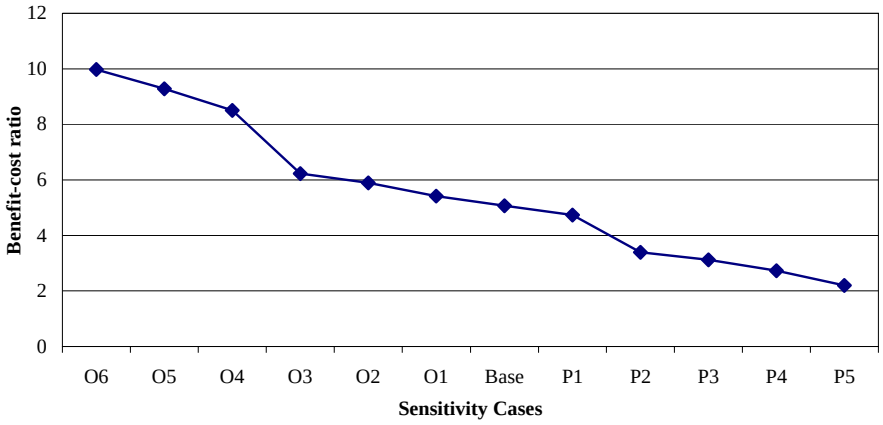


Table 5. Sensitivity analysis of selected cases

		Optimistic						Base	Pessimistic				
Input variables		O6	O5	O4	O3	O2	O1		P1	P2	P3	P4	P5
e=		2.5	2.5	2.5	2	2	2	2	2	1.5	1.5	1.5	1
Discount rate		8%	8%	10%	10%	10%	10%	12%	12%	12%	15%	15%	15%
Stream of long-term benefits (%)		60%	60%	60%	60%	50%	50%	50%	50%	50%	50%	30%	30%
Life of benefit (years)		15	15	15	15	15	12	12	10	10	10	10	10
Early period benefit	2003	150%	120%	120%	120%	120%	120%	120%	120%	90%	90%	60%	60%
	2002	75%	50%	50%	50%	50%	50%	50%	50%	45%	45%	40%	40%
Benefit-cost ratio													
Nutrition		6.62	6.17	5.65	4.58	4.34	3.98	3.73	3.47	2.71	2.49	2.18	1.88
Health		3.44	3.19	2.93	1.72	1.61	1.49	1.40	1.32	0.74	0.69	0.59	0.37
Financial asset		-0.08	-0.08	-0.07	-0.07	-0.07	-0.06	-0.06	-0.06	-0.06	-0.05	-0.05	-0.05
Total benefit-cost ratio		**9.98**	**9.28**	**8.50**	**6.23**	**5.89**	**5.41**	**5.07**	**4.73**	**3.39**	**3.12**	**2.73**	**2.20**
IRR		**128%**	**102%**	**102%**	**76%**	**76%**	**76%**	**76%**	**76%**	**52%**	**52%**	**45%**	**36%**

A comparison of costs with other ultra poor programmes

There are a number of programmes involving either cash or food transfers – as in the CFPR – and aimed at improving the sustainability of the households covered. A summary listing of 12 such programmes is available in Ahmed (2005). This paper also covers three of these programmes in detail which are:

- **IGVGD** (Income Generation for Vulnerable Group Development) programme is targeted at destitute women. It entails food transfers on condition that the transfers are used not just for immediate consumption but also to enable the development of the savings habit and to ensure participation in skill development programmes. Once the women have been empowered by savings and basic skills, the use of credit facilities is encouraged.
- **PESP** (Primary Education Stipend Programme) is targeted for children of poor parents to emancipate them from other activities and enable them to acquire education. Usually the mother receives cash in this programme if the child attends 85% of school days and obtains at least 40% marks in school exams.
- **RMP** (Rural Maintenance Programme) addresses destitute women by empowering them with finance and training and engaging them in work outside home in maintaining the rural roads network. It facilitates saving by the family and engagement with rural credit programmes.

All these programmes entail direct transfers (cash or food) to the participating family in a way that is similar to SUP. Each is different too, in that SUP involves the direct transfer of a productive asset – animals, land or tools – which the other programmes do not. The costs of the other programme are compared with the SUP costs. Under IGVGD, World Food Programme (WFP) provides the food directly to the selected women whereas all support activities like skill training and group development are undertaken by BRAC.

Table 6. Costs incurred by SUP compared with other programmes for ultra poor households in Bangladesh

Indicators	SUP	IGVGD	PESP	RMP
Delivery cost/beneficiary/cycle	14,303	3,765	283	4,708
Direct subsidy/beneficiary/cycle	11,322	3,929	6,856	16,384
Total cost/beneficiary/cycle, Tk.	25,624	7,693	7,138	21,092
US$	434	130	121	357
Costs as percentage compared to SUP costs	100%	29%	27%	80%

Source: SUP cost was collected from BRAC's Accounts Department and IGVGD from BRAC's Accounts Department and WFP. PESP and RMP costs were obtained from Ahmed (2005).

The SUP is a much more expensive programme than IGVGD (Table 6). However, there are two factors to be considered here:

- The provision of productive asset as well as food subsidies adds substantially to the overall cost of SUP.
- The costs of SUP declined in later cycles, reducing to an expected cost of US$ 256 per participant family for the 2005-06 cohort of 25,500 ultra poor households. The 2005-06 cost represents a decline of around 41% from the US$ 434 per family (at 2004 prices) incurred for the first cohort. The IGVGD costs collected independently from BRAC and WFP are around 51% of the long-term costs of SUP while PESP costs are marginally less than IGVGD. RMP costs appear to be higher than the long-term costs of SUP.

Conclusion

The objective of this paper was to carry out a cost-benefit analysis for the first cohort of first phase of BRAC's CFPR. Benefit is measured as the increase in expenditure on food consumption, increase in medical expenses and/or income foregone from workdays lost as a result of an increase in the (financial) capacity to take such decisions, and increase in net financial and housing assets of the SUP households compared to NSUP households. An alternative calculation of benefit has also been carried out by using the increase in per capita income of the SUP households compared to NSUP households. A sensitivity analysis of the B-C ratio was also carried out using consumption indicators.

The calculation using the consumption indicators yields a B-C ratio of 5.07 for the base case. This yields internal rate of return 76%. Using income indicators the B-C ratio works out to 3.83. However, the B-C ratio using income indicator is likely to be underestimated because income data from surveys are known to be unreliable as a measure of benefit. This is because respondents are likely to under-report in such programmes with the hope that they could derive further benefit from continuing to be recognized as ultra poor. Consequently, this alternative calculation should be seen as a secondary result, setting perhaps a lower limit on the B-C ratio for the programme. However, sensitivity analysis of the B-C ratio using consumption indicators shows that within a reasonable range of assumptions from relatively pessimistic to reasonably optimistic the B-C ratio lies in the range of 3.12-6.23, using discount rates in the range of 10% to 15% and the life of the benefit in the 10-15 years range.

Any benefit-cost ratio in excess of 3 represents high level of return, as indicated by the internal rates of return. Thus, it is apparent that the SUP component of the CFPR has delivered high level of benefits in relation to the cost incurred. This is in spite of the fact that the change in other consumption expenses such as on clothes of the SUP households has not been included in this analysis.

Since the benefit calculation carried out in this paper has not taken into account of some of consumption expenses such as on clothes and the long-term cost is significantly lower, even the high benefit cost ratio of 5.07 obtained for the base case assumptions is likely to be much lower than the real figure. Based on this analysis of the available evidence the investments made in the CFPR can be

judged to be highly productive with obvious implications for additional investments. The implications for wider replication of the model within the country as well as in other poor countries are also apparent.

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Annex

Annex 1. Typical outputs (reported as benefits of CFPR) but not included in cost-benefit analysis for lack of information on impact outcomes

Description	Achievement of 2002-03 cohort in June 2005 (cumulative from January 2002)
General Education	
No. of SUP members who have learnt to write their names	4,865
Human rights and legal affairs	
No. of SUP who know about dowry law	5,000
No. of SUP who know about divorce law	5,000
No. of SUP who know about early marriage law	5,000
Old couples have registered their marriage after inclusion in the programme	23
New couples have registered their marriage after inclusion in the programme	267
No. of SUP getting legal assistance from BRAC	310
Total no. of marriage	223
No. of marriages without dowry	78
No. of early marriages	1
No. of early marriages stopped	120
No. of polygamy	1
No. of polygamy stopped	46
No. of divorce	3
No. of illegal divorce	5
No. of illegal divorce stopped	41
Child education	
No. of children (aged 5-14) that can be enrolled in school but are not going to school	51
No. of children enrolled in school through CFPR	1,482

Source: BRAC (2005)

Annex 2. Benefit-cost ratio calculation– detailed methodology

Costs

$C = \Sigma(C_{02,} C_{03})$

Where, all values are inflated to 2004 price levels using the Consumer Price Index, Rural and $C_{02,} C_{03}$ are the costs allocated to $Cohort_{2002\text{-}03}$ collected from BRAC's Accounts Department. All sub-scripts indicate the last two digits of the reference year. So C_{02} refers to costs in 2002 and C_{03} refers to costs in 2003.

Nutrition (Food Consumption) Benefits

$N = N_{02}*(1+\delta)^2+N_{03}*(1+\delta)+N_{04}+\Sigma(N_{05}/(1+\delta)+N_{06}/(1+\delta)^2 \ldots N_{16}/(1+\delta)^{12})$

where

$N_{02} = 50\%N_{04}$

$N_{03} = 120\%N_{04}$

– the higher proportion of the benefit here relative to 2004 covers the fact that the major portion of the food distribution and other subsidies will have taken place at that during the year. In 2003, the programme reached all the households selected for the first cohort.

N_{05} = a lower proportion of N_{04} that has been varied for the purpose of the sensitivity analysis

N_{06} = 75% of N_{04}

$N_{07} \ldots N_{16}$ are declining proportions of N_{04} until 2009 and a constant proportion thereafter

$N_{05} \ldots N_{16}$ are discounted to 2004 using discount factor, δ

Health Benefits

$H = H_{02}*(1+\delta)^2+H_{03}*(1+\delta)+H_{04}+\Sigma\ [H_{05}/(1+\delta)+\Sigma(H_{06}/(1+\delta)^2 \ldots H_{16}/(1+\delta)^{12})]$

where

$H_{02} = 50\%H_{04}$

$H_{03} = 120\%H_{04}$

– the explanation above for higher benefits in 2003 compared to 2004 is equally applicable here.

H_{05} = a lower proportion of H_{04} that has been varied for the purpose of the sensitivity analysis

$H_{06} = 75\%\ H_{04}$

$H_{07} \ldots H_{16}$ are declining proportions of H_{04} until 2009 and a constant proportion thereafter

$H_{05} \ldots H_{16}$ are discounted to 2004 using discount factor, δ

Financial Assets (+housing assets)

$A = A_{02}*(1+\delta)^2+A_{03}*(1+\delta)+A_{04}+\Sigma(A_{05}/(1+\delta)+A_{06}/(1+\delta)^2 \ldots A_{16}/(1+\delta)^{12})$

Here assets = [Increase in savings] + [Increase in lending] + [Improvements effected in housing] – [Increase in borrowing]

$A_{02} = 45\%A_{04}$

$A_{03} = 90\%A_{04}$

A_{05} = a lower proportion of A_{04} that has been varied for the purpose of the sensitivity Analysis

$A_{06} = 75\%$ of A_{04}

$A_{07} \ldots A_{16}$ are declining proportions of A_{04} until 2009 and a constant proportion thereafter

Total Benefits

$B = W^{des}N^{des} + W^{up}N^{up} + W^{poor}N^{poor} + W^{np}N^{np} + W^{up}H^{up} + W^{poor}H^{poor} + W^{np}H^{np} + A$

where W are the weights attached to each respective sub-category of households for each type of benefit. The weight varies with the social value attached to the elasticity of the marginal utility of consumption.

And the benefit-cost (B-C) ratio = B/C

Annex 3. Calculation of nutrition benefits accrued by each sub-category of households

3A. Households with energy consumption <1600 kcal per person per day (destitute households)

3A.1. Food expenditure incurred by SUP and NSUP in 2002

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	255.23	240.77	14.35	3454.98	274.44	293.51	14.35	4211.87
Pulses	6.01	5.67	20.52	116.36	9.20	9.84	20.52	201.92
Oil	7.62	7.19	60.62	435.87	6.60	7.06	60.62	427.93
Fish	9.17	8.65	140.70	1216.91	6.53	6.98	140.70	981.91
Vegetables	182.92	172.56	10.54	1818.79	163.38	174.74	10.54	1841.75
Fruits	9.45	8.92	7.00	62.41	22.10	23.64	7.00	165.48
Total animals (milk, meet and egg)	10.40	9.81	91.63	898.77	4.26	4.56	91.63	417.42
Total				8004.08				8248.29

* 2.58 persons per household and 365 days per year
** 2.93 persons per household and 365 days per year

3A.2. Food expenditure incurred by SUP and NSUP in 2004

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	441.02	545.13	14.90	8124.19	429.64	514.56	14.90	7668.53
Pulses	9.38	11.60	21.60	250.47	7.38	8.84	21.60	190.85
Oil	7.52	9.30	64.63	601.04	6.25	7.48	64.63	483.57
Fish	22.19	27.43	142.33	3903.99	13.75	16.46	142.33	2342.94
Vegetables	259.25	320.45	10.76	3447.46	235.73	282.33	10.76	3037.35
Fruits	131.83	162.96	6.75	1099.47	61.88	74.11	6.75	500.04
Total animals (milk, meet and egg)	51.17	63.25	97.72	6181.02	19.06	22.83	97.72	2231.14
Total				23607.64				16454.43

*3.39 persons per household and 365 days per year

**3.28 persons per household and 365 days per year

3A.3. Food expenditure incurred by SUP and NSUP in 2006

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	518.73	500.25	19.00	9,504.79	450.20	457.75	19.00	8,697.21
Pulses	9.03	8.71	34.00	296.02	5.79	5.89	34.00	200.17
Oil	9.04	8.72	52.00	453.55	8.66	8.81	52.00	458.03
Fish	35.89	34.61	250.00	8,653.70	26.92	27.37	250.00	6,842.78
Vegetables	262.42	253.07	18.00	4,555.34	229.37	233.21	18.00	4,197.82
Fruits	65.05	62.73	8.00	501.84	38.29	38.93	8.00	311.42
Total animals (milk, meet and egg)	44.00	42.43	130.00	5516.29	22.92	23.31	130.00	3029.94
Total				29481.54				23737.37

*2.64 persons per household and 365 days per year
**2.79 persons per household and 365 days per year

3A.4. Calculation of benefits from food expenditure

(In Taka)

Using survey data of year	SUP minus NSUP
2002	-244.21
2004	7153.21
2006	5744.17
Difference in difference (2004 over 2002) after accounting for inflation	7430.15
Difference in difference (2006 over 2002)) after accounting for inflation	5190.68
Difference in difference (2006 over 2004)) after accounting for inflation	-2239.47
Number of households	41.04% of 5000
Weight at e=2	3.69
Benefit (weighted) in 2004 over 2002	56328380.84
Benefit (weighted) in 2006 over 2002	39350853.02
Changes in benefit during 2004 to 2006	-16977527.82

3B. Households with energy consumption 1,600-1,800 kcal per person per day (ultra poor households)

3B.1. Food expenditure incurred by SUP and NSUP in 2002

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	430.49	529.81	14.35	7602.71	409.39	545.35	14.35	7,825.74
Pulses	14.05	17.30	20.52	354.83	7.43	9.90	20.52	203.08
Oil	6.05	7.45	60.62	451.63	8.24	10.97	60.62	665.13
Fish	10.08	12.41	140.70	1,745.56	14.72	19.61	140.70	2,759.15
Vegetables	177.49	218.44	10.54	2,302.32	196.48	261.73	10.54	2,758.67
Fruits	0.00	0.00	7.00	0.00	51.67	68.83	7.00	481.81
Total animals (milk, meet and egg)	6.87	8.45	91.63	774.72	26.67	35.53	91.63	3255.40
Total				13,231.76				17,948.99

*3.37 persons per household and 365 days per year
**3.65 persons per household and 365 days per year

3B.2. Food expenditure incurred by SUP and NSUP in 2004

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	490.79	585.65	14.90	8,727.96	360.17	485.95	14.90	7,242.22
Pulses	8.48	10.11	21.6900	218.43	3.28	4.42	21.60	95.53
Oil	5.55	6.63	64.63	428.40	3.97	5.35	64.63	345.87
Fish	21.74	25.94	142.33	3,691.63	11.83	15.96	142.33	2,272.14
Vegetables	241.85	288.59	10.76	3,104.67	190.78	257.40	10.76	2,769.20
Fruits	130.01	155.14	6.75	1,046.71	160.78	216.93	6.75	1,463.62
Total animals (milk, meet and egg)	41.77	49.85	97.72	4,870.95	24.69	33.31	97.72	3,255.13
Total				22,088.75				17,443.71

*3.27 persons per household and 365 days per year
**3.70 persons per household and 365 days per year

3B.3. Food expenditure incurred by SUP and NSUP in 2006

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	440.45	477.14	19.00	9,065.59	397.49	496.87	19.00	9,440.52
Pulses	6.99	7.58	34.00	257.56	8.99	11.24	34.00	382.27
Oil	8.86	9.60	52.00	499.16	8.78	10.97	52.00	570.63
Fish	35.90	38.89	250.00	9,721.73	24.99	31.23	250.00	7,808.34
Vegetables	226.66	245.55	18.00	4,419.83	192.62	240.78	18.00	4,334.03
Fruits	48.59	52.63	8.00	421.06	27.76	34.70	8.00	277.62
Total animals (milk, meet and egg)	30.99	33.57	130.00	4,364.20	22.03	27.53	130.00	3,579.19
Total				28749.14				26392.60

*2.97 persons per household and 365 days per year
**3.42 persons per household and 365 days per year

3B.4. Calculation of benefits from food expenditure

(In Taka)

Using survey data of year	SUP minus NSUP
2002	-4717.23
2004	4645.04
2006	2356.54
Difference in difference (2004 over 2002) after accounting for inflation	9994.37
Difference in difference (2006 over 2002) after accounting for inflation	7365.19
Difference in difference (2006 over 2004) after accounting for inflation	-2629.18
Number of households	7.51% of 5000
Weight at e=2	1.58
Benefit (weighted) in 2004 over 2002	5930774.36
Benefit (weighted) in 2006 over 2002	4370587.82
Changes in benefit during 2004 to 2006	-1560186.54

3C. Households with energy consumption 1800-2122 kcal per person per day (poor households)

3C.1. Food expenditure incurred by SUP and NSUP in 2002

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	492.76	425.14	14.35	6,100.77	493.36	398.70	14.35	5,721.33
Pulses	7.86	6.78	20.52	139.14	7.89	6.38	20.52	130.78
Oil	11.35	9.79	60.62	593.70	10.13	8.18	60.62	496.11
Fish	12.65	10.91	140.70	1,535.39	9.45	7.64	140.70	1,074.31
Vegetables	201.29	173.67	10.54	1,830.46	253.49	204.85	10.54	2,159.17
Fruits	21.53	18.57	7.00	130.02	6.98	5.64	7.00	39.46
Total animals (milk, meet and egg)	4.52	3.90	91.63	357.63	7.06	5.70	91.63	522.70
Total				10,687.11				10,143.87

*2.36 persons per household and 365 days per year
**2.21 persons per household and 365 days per year

3C.2. Food expenditure incurred by SUP and NSUP in 2004

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	486.15	530.69	14.90	7,908.95	464.22	423.05	14.90	6,304.70
Pulses	11.97	13.06	21.60	282.13	3.84	3.50	21.60	75.61
Oil	8.36	9.12	64.63	589.75	6.34	5.78	64.63	373.68
Fish	33.17	36.21	142.33	5,153.57	14.86	13.54	142.33	1,927.30
Vegetables	327.89	357.93	10.76	3,850.68	247.54	225.59	10.76	2,426.90
Fruits	131.20	143.22	6.75	966.29	110.94	101.10	6.75	682.12
Total animals (milk, meet and egg)	56.86	62.07	97.72	6,064.98	17.15	15.63	97.72	1,527.61
Total				24,816.34				13,317.93

*2.99 persons per household and 365 days per year
**2.50 persons per household and 365 days per year

3C.3. Food expenditure incurred by SUP and NSUP in 2006

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of Food per household, Tk. per year
Cereals	559.48	548.03	19.00	10,412.66	450.22	361.74	19.00	6,873.05
Pulses	11.65	11.41	34.00	387.99	8.60	6.91	34.00	235.04
Oil	8.68	8.51	52.00	442.26	8.37	6.73	52.00	349.71
Fish	35.43	34.71	250.00	8,677.24	38.61	31.02	250.00	7,755.81
Vegetables	279.86	274.14	18.00	4,934.50	227.80	183.03	18.00	3,294.50
Fruits	61.61	60.35	8.00	482.79	14.44	11.60	8.00	92.81
Total animals (milk, meet and egg)	42.12	41.25	130.00	5,362.98	9.73	7.82	130.00	1,016.73
Total				30700.41				19617.65

*2.68 persons per household and 365 days per year
**2.20 persons per household and 365 days per year

3C.4. Calculation of benefits from food expenditure

(In Taka)

Using survey data of year	SUP minus NSUP
2002	543.24
2004	11498.41
2006	11082.76
Difference in difference (2004 over 2002) after accounting for inflation	10882.37
Difference in difference (2006 over 2002) after accounting for inflation	8864.51
Difference in difference (2006 over 2004) after accounting for inflation	-2017.87
Number of households	24.28% of 5000
Weight at e=2	1.15
Benefit (weighted) in 2004 over 2002	15251020.96
Benefit (weighted) in 2006 over 2002	12423096.14
Changes in benefit during 2004 to 2006	-2827924.83

3D. Households with energy consumption >2122 kcal per person per day (not so poor households)

3D.1. Food expenditure incurred by SUP and NSUP in 2002

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	634.81	599.12	14.35	8,597.33	641.27	607.99	14.35	8,724.59
Pulses	6.84	6.46	20.52	132.48	7.01	6.65	20.52	136.35
Oil	9.32	8.80	60.62	533.28	10.42	9.88	60.62	598.90
Fish	24.00	22.65	140.70	3,186.75	16.92	16.04	140.70	2,257.44
Vegetables	291.77	275.37	10.54	2,902.39	250.13	237.15	10.54	2,499.55
Fruits	13.75	12.98	7.00	90.84	54.48	51.65	7.00	361.56
Total animals (milk, meet and egg)	12.03	11.35	91.63	1,040.25	13.96	13.23	91.63	1,212.39
Total				16,483.31				15,790.78

*2.59 persons per household and 365 days per year
**2.60 persons per household and 365 days per year

3D.2. Food expenditure incurred by SUP and NSUP in 2004

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of Food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, TK./kg	Cost of food per household, Tk. per year
Cereals	506.64	629.75	14.90	9,385.24	441.81	558.69	14.90	8,326.21
Pulses	12.30	15.29	21.60	330.24	4.22	5.33	21.60	115.20
Oil	7.58	9.43	64.63	609.34	5.97	7.55	64.63	488.15
Fish	26.26	32.64	142.33	4,645.28	8.18	10.35	142.33	1,472.85
Vegetables	300.83	373.93	10.76	4,022.80	238.80	301.97	10.76	3,248.70
Fruits	141.37	175.71	6.75	1,185.55	50.79	64.23	6.75	433.33
Total animals (milk, meet and egg)	52.96	65.83	97.72	6,432.49	19.62	24.82	97.72	2,425.06
Total				26,610.96				16,509.50

*3.41 persons per household and 365 days per year
**3.46 persons per household and 365 days per year

3D.3. Food expenditure incurred by SUP and NSUP in 2006

Items	SUP				NSUP			
	Consumption in gm per person per day	Household consumption in kg per year*	Price, Tk./kg	Cost of food per household, Tk. per year	Consumption in gm per person per day	Household consumption in kg per year**	Price, Tk./kg	Cost of food per household, Tk. per year
Cereals	567.11	656.95	19.00	12,482.01	530.49	550.22	19.00	10,454.17
Pulses	8.56	9.92	34.00	337.12	8.38	8.69	34.00	295.36
Oil	8.97	10.39	52.00	540.23	7.82	8.11	52.00	421.84
Fish	47.99	55.59	250.00	13,896.73	23.27	24.14	250.00	6,034.90
Vegetables	272.62	315.81	18.00	5,684.55	244.35	253.44	18.00	4,561.85
Fruits	83.26	96.45	8.00	771.61	26.17	27.14	8.00	217.11
Total animals	54.67	63.34	130.00	8,233.65	17.54	18.19	130.00	2,364.72
Total				41945.91				24349.96

*3.17 persons per household and 365 days per year
**2.84 persons per household and 365 days per year

3D.4. Calculation of benefits from food expenditure

(In Taka)

Using survey data of year	SUP minus NSUP
2002	692.54
2004	10101.46
2006	17595.95
Difference in difference (2004 over 2002) after accounting for inflation	9316.12
Difference in difference (2006 over 2002) after accounting for inflation	14266.80
Difference in difference (2006 over 2004) after accounting for inflation	4950.68
Number of households	27.17% of 5000
Weight at e=2	0.74
Benefit (weighted) in 2004 over 2002	9378897.40
Benefit (weighted) in 2006 over 2002	14362936.24
Changes in benefit during 2004 to 2006	4984038.84

Annex 4. Calculation of health benefits accrued by each sub-category of households

4A. Households with per capita income <Tk. 1970 (ultra poor households)

4A.1. Health expenses incurred by SUP and NSUP in 2002 and 2005

Year		Workdays lost/Household/ 15 days	Total workdays lost/year	Wage/day, Tk.	Cost of lost productive days, per household	Medical expenditure/ household/15 days, Tk.	Medical expenditure for the year, Tk. per household	Total health cost, Tk. per household
2002	SUP	0.78	18.84	46.07	867.88	28.71	689.04	1556.92
	NSUP	0.95	22.70	46.07	1045.88	62.94	1510.65	2556.53
2005	SUP	1.82	43.56	49.27	2146.62	69.77	1674.54	3821.16
	NSUP	1.80	43.20	49.27	2128.64	85.56	2053.32	4181.96

4A.2. Calculation of benefit from health expenditure

(In Taka)

Using survey data of year	SUP minus NSUP
2002	-999.61
2005	-360.81
Difference in difference after accounting for inflation	810.59
Number of households	52.2% of 5000
Weight for this sub-cohort at e=2	11.54
Weighted benefit of increased health expenditure by sub- cohort	24414559.63

4B. Households with per capita income of Tk. 1970-3940 (poor households)

4B.1. Health expenses incurred by SUP and NSUP in 2002 and 2005

Year		Work days lost/Household/ 15 days	Total workdays lost/year	Wage/day, Tk.	Cost of lost productive days, per household	Medical expenditure/ household/15 days, Tk..	Medical expenditure for the year, Tk. per household	Total health cost, Tk. per household
2002	SUP	0.61	14.76	46.06	679.83	28.48	683.52	1363.35
	NSUP	0.74	17.65	46.06	812.94	64.20	1540.80	2353.74
2005	SUP	1.49	35.64	49.27	1756.13	82.70	1984.80	3740.93
	NSUP	1.49	35.87	49.27	1767.25	53.42	1282.08	3049.33

4B.2. Calculation of benefits from health expenditure

(In Taka)

Using survey data of year	SUP minus NSUP
2002 2005	-990.39 691.60
Difference in difference after accounting for inflation	1802.87
Number of households	36.3% of 5000
Weight for this sub-cohort at e=2	2.24
Weighted benefit of increased health expenditure by sub cohort	7329737.54

4C. Households with per capita income >Tk. 3940 (not so poor households)

4C.1. Health expenses incurred by SUP and NSUP in 2002 and 2005

Year		Work days lost/Household/ 15 days	Total workdays lost/year	Wage/day, Tk.	Cost of lost productive days, per household	Medical expenditure/ household/15 days, Taka	Medical expenditure for the year, Tk. per household	Total health cost, Tk. per household
2002	SUP	0.71	16.92	46.07	779.43	23.74	569.74	1349.17
	NSUP	0.43	10.21	46.07	470.33	32.15	771.65	1241.98
2005	SUP	1.54	36.97	49.27	1821.69	46.56	1117.32	2939.02
	NSUP	1.48	35.47	49.27	1747.73	57.00	1367.93	3115.67

4C.2. Calculation of benefits from health expenditure

(In Taka)

Using survey data of year	SUP minus NSUP
2002 2005	107.19 -176.65
Difference in difference after accounting for inflation	-292.12
Number of households	11.4% of 5000
Weight for this sub-cohort at e=2	0.48
Weighted benefit of increased health expenditure by sub cohort	-80275.51

Annex 5. Calculation of asset and financial benefits

5A. Savings, lending, housing and borrowing of SUP and NSUP in 2002 and 2005

	Value/household (Tk.)	% of households	Total household	Total value (Tk.)
SUP 2002				
Savings	250	8.13%	5,000	101625
Lending	1,144	0.76%	5,000	43,472
Housing	856	100.00%	5,000	4,281,100
Borrowing	1,103	21.22%	5,000	1,170,283
Total				3,154,289
NSUP 2002				
Savings	250	20.39%	5,000	254875
Lending	3,107	0.96%	5,000	149,136
Housing	1,543	100.00%	5,000	7,712,650
Borrowing	2,405	33.99%	5,000	4,087,297
Total				3,774,488
SUP 2005				
Savings	250	98.44%	5,000	1,230,500
Lending	2,426	6.95%	5,000	843,035
Housing	2,130	100%	5,000	10,652,300
Borrowing	2,262	57.89%	5,000	6,547,359
Total				4,947,976
NSUP 2005				
Savings	250	28.57%	5,000	357,125
Lending	2,501	2.97%	5,000	371,398
Housing	2,609	100%	5,000	13,042,700
Borrowing	2,448	42.31%	5,000	5,178,744
Total				8,235,354

5B. Calculation of benefits from savings, lending, housing and borrowing

(In Taka)

Using data of year	SUP minus NSUP
Saving	
2002	-153,250
2005	873,375
Difference in difference after accounting for inflation	1,008,023
Lending	
2002	-105,664
2005	471,637
Difference in difference after accounting for inflation	570,691
Housing	
2002	-3,431,550
2005	-2,390,400
Difference in difference after accounting for inflation	1,669,711
Borrowing	
2002	-2,917,015
2005	1,368,615
Difference in difference after accounting for inflation	4,494,657
Saving + Lending +Housing –Borrowing	-1,409,584

Annex 6. Benefit calculation using income

6A. Households with per capita income <Tk. 1970 (ultra poor households)

6A.1. Average income of SUP and NSUP households in 2002 and 2005

	2002			2005		
	Per capita income, Tk.	Household size	Household income, Tk.	Per capita income, Tk.	Household size	Household income, Tk.
SUP	1,157.04	4.19	4,848.36	4,347.67	3.96	17,229.40
NSUP	1,152.20	4.39	5,062.09	3,472.81	4.06	14,113.86

6A.2. Calculation of benefit

(In Taka)

Using survey data of year	SUP minus NSUP
2002	-213.73
2005	3,115.55
Difference in difference after accounting for inflation	30.52.72
Number of households	52.2% of 5000
Weight for this sub-cohort at e=2	11.54
Weighted benefit of increased income by sub-cohort	91974056.09

6B. Households with per capita income of Tk. 1,970-3,940 (poor households)

6B.1. Average income of SUP and NSUP households in 2002 and 2005

	2002			2005		
	Per capita Income, Tk.	Household size	Household income, Tk.	Per capita income, Tk.	Household size	Household income, Tk.
SUP	2,698.65	3.24	8,746.39	4,978.07	3.27	16,295.55
NSUP	2,736.74	3.64	9,963.07	4,085.41	3.63	14,812.45

6B.2. Calculation of benefit

(In Taka)

Using survey data of year	SUP minus NSUP
2002 2005	-1,216.67 1,483.10
Difference in difference after accounting for inflation	2,702.14
Number of households	36.3% of 5000
Weight for this sub-cohort at e=2	2.24
Weighted benefit of increased income by sub-cohort	11002862.94

6C. Households with per capita income >Tk. 3,940 (not so poor households)

6C.1. Average income of SUP and NSUP households in 2002 and 2005

	2002			2005		
	Per capita income, Tk.	Household size	Household income, Tk.	Per capita income, Tk.	Household size	Household income, Tk.
SUP	5,596.38	2.26	12,674.15	6,739.69	2.52	16,973.11
NSUP	5,891.73	2.71	15,982.53	5,138.32	2.97	15,258.81

6C.2. Calculation of benefit

(In Taka)

Using survey data of year	SUP minus NSUP
2002 2005	-3,308.38 1,714.29
Difference in difference after accounting for inflation	5254.00
Number of households	11.4% of 5000
Weight for this sub-cohort at e=2	0.48
Weighted benefit of increased income by sub-cohort	1447388.53

Annex 7. Benefit-cost ratio (base case)

7A. Benefit-cost ratio using consumption as the benefit measure at e=2, discount rate =12% and life of benefit=12 years

(In million Tk)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	PV
Cost	122.98	35.59											158.56
Nutrition benefit (weighted)													
Households with energy consumption <1,600 kcal (weight=3.69)	28.16	67.59	56.33	50.70	42.25	36.61	30.98	28.16	28.16	28.16	28.16	28.16	356.58
Households with energy consumption 1,600-1,800 kcal (weight=1.58)	2.97	7.12	5.93	5.34	4.45	3.86	3.26	2.97	2.97	2.97	2.97	2.97	37.57
Households with energy consumption 1,800-2,122 kcal (weight=1.15)	7.62	18.30	15.25	13.72	11.44	9.91	8.39	7.62	7.62	7.62	7.62	7.62	96.53
Households with energy consumption >2,122 kcal (weight=0.74)	4.69	11.25	9.38	12.19	14.07	14.07	14.07	14.07	14.07	14.07	14.07	14.07	101.14
Total	43.45	104.27	86.89	81.95	72.20	64.45	56.70	52.82	52.82	52.82	52.82	52.82	591.82
Stream of benefits (%)*	50%	120%	100%	90%	75%	65%	55%	50%	50%	50%	50%	50%	
Nutrition benefit-cost ratio													*3.73*

[Continued...]

Annex 7 (Continued...)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	PV
Health benefit (weighted)													
Households with per capita income <1970 (weight=11.54)	13.56	32.55	27.13	24.41	20.34	17.63	14.92	13.56	13.56	13.56	13.56	13.56	171.71
Households with per capita income 1970-3940 (weight=2.24)	4.07	9.77	8.14	7.33	6.11	5.29	4.48	4.07	4.07	4.07	4.07	4.07	51.55
Households with per capita income >3940 (weight=0.48)	-0.04	-0.11	-0.09	-0.08	-0.07	-0.06	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04	-0.56
Total	17.59	42.21	35.18	31.66	26.38	22.86	19.35	17.59	17.59	17.59	17.59	17.59	222.70
Stream of benefits (%)	50%	120%	100%	90%	75%	65%	55%	50%	50%	50%	50%	50%	
Health benefit- cost ratio													*1.40*
Net asset benefit: finance + housing		-0.70	-1.41	-1.57	-1.41	-1.17	-1.02	-0.86	-0.78	-0.78	-0.78	-0.78	-9.29
Stream of benefits (%)	45%	90%	100%	90%	75%	65%	55%	50%	50%	50%	50%	50%	
Net asset benefit-cost ratio													*-0.06*
Total benefit (nutrition, health and asset)													*805.23*
Benefit-cost ratio													5.07
IRR (%)													76

*For the top group of households (>2,122 kcal), benefit in 2005 is 130% and long-term benefit is 150% per year.

7B. Benefit-cost ratio using income as the benefit measure at e=2, discount rate =12% and life of benefit =12 years

(In million Tk)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Present value
Costs	122.98	35.59											158.56
Income benefit													
Households with per capita income <1,970 (weight=11.54)	27.59	64.38	101.17	91.97	73.58	64.38	55.18	45.99	45.99	45.99	45.99	45.99	534.92
Households with per capita income 1,970-3,940 (weight=2.24)	3.30	7.70	12.10	11.00	8.80	7.70	6.60	5.50	5.50	5.50	5.50	5.50	63.99
Households with per capita income >3,940 (weight=0.48)	0.43	1.01	1.59	1.45	1.16	1.01	0.87	0.72	0.72	0.72	0.72	0.72	8.42
Stream of benefits (%)	30%	70%	110%	100%	80%	70%	60%	50%	50%	50%	50%	50%	
Total benefit													607.33
Benefit-cost ratio													3.83

Annex 8. Details of sensitivity analysis

Social value (e)	Streams of long-term benefit (%)		
	Optimistic	Base	Pessimistic
	60%	50%	30%
Life of benefit =15 years; Discount rate =15%			
e=2.5	7.03	6.70	6.13
e=2.0	5.14	4.91	4.50
e=1.5	3.94	3.77	3.48
e=1.0	3.16	3.03	2.82
e=0.5	2.65	2.56	2.39
e=0	2.32	2.25	2.11
Life of benefit =15 years; Discount rate =12%			
e=2.5	7.85	7.43	6.70
e=2.0	5.74	5.45	4.94
e=1.5	4.40	4.19	3.83
e=1.0	3.54	3.39	3.11
e=0.5	2.98	2.86	2.65
e=0	2.62	2.52	2.35
Life of benefit =15 years; Discount rate =10%			
e=2.5	8.50	8.02	7.16
e=2.0	6.23	5.89	5.28
e=1.5	4.78	4.54	4.10
e=1.0	3.85	3.67	3.35
e=0.5	3.25	3.11	2.86
e=0	2.85	2.74	2.55
Life of benefit =15 years; Discount rate =8%			
e=2.5	9.28	8.71	7.68
e=2.0	6.80	6.40	5.69
e=1.5	5.23	4.94	4.42
e=1.0	4.22	4.00	3.62
e=0.5	3.56	3.40	3.10
e=0	3.14	3.00	2.77
Life of benefit =12 years; Discount rate =15%			
e=2.5	6.61	6.34	5.89
e=2.0	4.82	4.63	4.32
e=1.5	3.69	3.55	3.32
e=1.0	2.96	2.85	2.68
e=0.5	2.48	2.40	2.27
e=0	2.16	2.10	2.00
Life of benefit =12 years; Discount rate =12%			
e=2.5	7.26	6.93	6.37
e=2.0	5.30	5.07	4.68
e=1.5	4.06	3.89	3.61
e=1.0	3.26	3.13	2.92
e=0.5	2.73	2.64	2.48
e=0	2.39	2.32	2.19

[Continued...]

Annex 8 (Continued...)

Social value (e)	Streams of long-term benefit (%)		
	Optimistic	Base	Pessimistic
	60%	50%	30%
Life of benefit =12 years; Discount rate =10%			
e=2.5	7.76	7.38	6.74
e=2.0	5.67	5.41	4.96
e=1.5	4.35	4.16	3.83
e=1.0	3.49	3.35	3.11
e=0.5	2.94	2.83	2.64
e=0	2.57	2.49	2.34
Life of benefit =12 years; Discount rate =8%			
e=2.5	8.34	7.90	7.16
e=2.0	6.10	5.80	5.27
e=1.5	4.68	4.46	4.08
e=1.0	3.77	3.60	3.32
e=0.5	3.17	3.04	2.83
e=0	2.78	2.68	2.51
Life of benefit =10 years; Discount rate =15%			
e=2.5	6.21	6.00	5.67
e=2.0	4.53	4.38	4.14
e=1.5	3.46	3.35	3.18
e=1.0	2.76	2.68	2.56
e=0.5	2.31	2.25	2.15
e=0	2.01	1.96	1.89
Life of benefit =10 years; Discount rate =12%			
e=2.5	6.73	6.48	6.08
e=2.0	4.91	4.73	4.45
e=1.5	3.75	3.63	3.42
e=1.0	3.01	2.91	2.76
e=0.5	2.52	2.44	2.33
e=0	2.20	2.14	2.05
Life of benefit =10 years; Discount rate =10%			
e=2.5	7.13	6.85	6.39
e=2.0	5.20	5.01	4.68
e=1.5	3.98	3.84	3.60
e=1.0	3.19	3.08	2.91
e=0.5	2.68	2.59	2.46
e=0	2.34	2.27	2.17
Life of benefit =10 years; Discount rate =8%			
e=2.5	7.58	7.26	6.73
e=2.0	5.54	5.31	4.94
e=1.5	4.24	4.07	3.81
e=1.0	3.40	3.28	3.08
e=0.5	2.85	2.76	2.61
e=0	2.50	2.42	2.30