IMPROVING BENEFIT COST ANALYSIS FOR MALAWI'S FARM INPUT SUBSIDY PROGRAMME, 2006/7 TO 2010/11

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1. Introduction

Previous benefit:cost analysis (BCA) of the Malawian Farm Input Subsidy Programme (FISP, formerly known as the Agricultural Input Subsidy Programme, AISP) has not allowed for wider consumer and growth benefits , and this has made it difficult to compare the programme's returns against estimates of returns to other possible investments, such as in roads or agricultural research, when these other estimates may include allowance for consumer and growth benefits. This paper presents results achieved with a method that allows for a wider range of benefits from the programme but nevertheless has relatively simple analytical and data demands.

2. Benefit - cost analysis purposes and principles

Benefit - cost analysis (BCA) of input subsidy programmes has two main functions:

- To give an indication of the returns to the programme as compared to returns that might be achieved from alternative investments, to guide overall government investment and spending decisions across, for example, agricultural input subsidies, research, and infrastructure.
- To provide information about the variables that are important in determining costs and benefits of a specific programme or type of programme, and hence guide programme design and implementation decisions.

These two uses of BCA present analysts with something of a dilemma as the first requires the use of common standards and methods for BCA across different programmes while the second requires accurate estimates of the relative importance of different variables in affecting returns in particular investments. This will often require tailoring methods to match specific programme features, and the results may not be comparable across analysis of different investments.

In this context, we suggest seven principles for the choice and implementation of BCA methods to provide rigorous, reliable, and objective estimates of benefits and costs. BCA methods applied in any situation should be

1. *Practicable*: applicable with available or obtainable data and analytical resources (skills and software for example);
2. *Externally consistent*: providing measures that are comparable with generally accepted good practice in definitions of costs and benefits;
3. *Contextualised*: taking account of particularities that affect the benefits and costs of a specific programme;
4. *Holistic*: taking account of all the significant benefits and costs associated with a policy or investment programme (both directly to recipients and indirectly to others);
5. *Internally consistent*: taking account of 'counterfactuals', comparing actual behaviours and outcomes with investments against those that would have occurred without them;
6. *Transparent*: stating and discussing assumptions, measures, data sources, shortcomings and possible bias and inaccuracies in methods and results;
7. *Cost effective*: chosen, developed and implemented to ensure that costs of analysis are commensurate with or proportional to the value of the information provided.

[1] For a full description of methods and results, and references, see Dorward, A. and E. Chirwa (2011) *Improving benefit cost analysis for Malawi's farm input subsidy programme, 2006/7 to 2010/11*. Working paper, August 2011

Cost effectiveness of methods is of course affected by the costs of BCA methods in providing information and in the value of the information provided.

- Costs are determined by resource demands for gathering extra information needed and for analysis
- The value of the information provided is determined by its quality and by the scope for its use.
    - Quality is determined by *external and internal consistency*, *holism* and *contextualization* and by strengths and weaknesses of analytical methods
    - Scope for use of information is determined by *transparency* of results, by the strengths and weaknesses of different methods, and by the potential 'decision space' for changes in policy choices, design and implementation in the light of information provided by BCA.

There are particular challenges in applying the first four of the principles above to the specific situation in which the FISP operates.

1. *Practicable*. There are severe limitations in data availability (for example on crop areas and yields, yield and production effects of subsidised seed and fertiliser, and the number of farm families in the country) and limited financial and human resources available for analysis. However, determination of the "counterfactual" situation is complex, involving changes in the whole economy in farm incomes, in food prices, and in the real incomes of consumers.
2. *Externally consistent*. Limited availability of good quality data poses problems for the application of good practice and a further difficulty arises with the long standing history of policy interventions inhibiting maize imports and exports, as this makes it very difficult to identify true economic prices for maize and what national prices would have been without the subsidy.
3. *Contextualised*. The effects of the subsidy on livelihoods are complex, widespread and in many ways specific to the problems faced by poor Malawian smallholders. Analysis has to take account of these contextual issues requiring more complex, non-standard analysis – but this conflicts with the two previous principles.
4. *Holistic*: The scale and nature of the FISP means that it has widespread, complex and varied effects on the livelihoods of different farm households, on consumers, and on maize and labour markets. Ideally this requires holistic consideration of dynamic and interacting changes in rural livelihoods and in rural and national markets, but this presents severe data and analytical challenges.

3. Benefit - cost analysis methods

Investment and policy analysis methods can be classified by the extent to which they focus on direct, 'partial equilibrium' effects of an investment or policy on specific beneficiaries as against wider, indirect 'general equilibrium' effects on beneficiaries and non-beneficiaries across all sectors in an economy. Consideration of wider indirect effect increases the analytical complexity and data requirements, but these effects may dominate the direct effects for large scale investments affecting food prices and the productivity of large areas of land and large amounts of labour – as is the case with the FISP.

It is helpful to distinguish between three basic methodological approaches to BCA for large scale policy investments:

a) *Regression models* estimate returns to investments by analysing comparative data sets across different regions in a country, for example, implicitly taking account of multipliers and wider general equilibrium market effects.
b) *Computable general equilibrium (CGE) and multi-market models* analyse the effects of investments by simulating economic behaviour with and without investments

c) Partial equilibrium models examine investment's welfare impacts on producers and consumers.

These models differ as regards data demands, analytical challenges, and ability to allow for market failures, differential effects on different types of consumers and producers, linkages and multipliers across markets, and the interactions between these. Table 1 sets out the broad characteristics of these three types of model.

Table 1 Broad characteristics of three model types

	Regression models	**CGE/ Multimarket models**	**Partial equilibrium models**
Data demands	Time series data for different relatively independent regions	National & multi-sectoral data on factor ownership, productivity & market. Productivity impacts of investment	Demand (& ideally supply) information on specific commodity/ies. Productivity impacts of investment
Capacity to describe multi-market, indirect effects	Good: intrinsic in analysis of broader welfare effects	Good: key benefit of these models: depends on quality of model formulation & data	Weak: no explicit consideration, but *ad hoc* adjustments can allow for these effects
Capacity to describe differential market failure effects	Good: intrinsic in analysis of broader welfare effects, may not capture spillovers	Weak: very challenging as regards data demands & model formulation	Weak: no explicit consideration, *ad hoc* adjustments can allow for these effects
Capacity to isolate effects of specified intervention(s)	Difficult if covariant changes or with varying spillovers across regions	Good, depending on quality of model	Can be good, depending on context & processes
Strengths	Can give very holistic empirical analysis	Multimarket effects, counterfactuals	Simpler data & analytical demands
Weaknesses	Demanding requirements for historical data sets; assumptions / context may not be explicit or generalisable; may not account for some spillover effects	Complex & demanding, esp. representation of market failures & differential behaviour of producers & consumers - otherwise misleading ; assumptions / context may not be explicit.	Does not take account of market effects – these can only be addressed with simple relatively *ad hoc* adjustments

It is clear from table 1 that the three approaches have different, and in many ways complementary features and strengths and weaknesses. We can conclude from this that

- different choices of method will be needed in different contexts
- In all cases analysts must recognise, take account of and document the limitations of their methods and data
- Use of BCA results to compare returns from different investments must take great care to allow for differences in analytical methods, issues and data quality
- Use of BCA results to guide investment design and implementation must allow for strengths and weaknesses in analytical methods, issues and data quality.
- In the particular situation of the Malawi FISP
  - empirical situations and data available do not allow the use of regression analysis
  - CGE and multi-market models are too expensive and complex and lack reliable data for regular and detailed year by year analysis
  - the more limited data and analytically demanding partial equilibrium models are the most practicable (though they still present significant challenges)
  - Major concerns among decision makers within Malawi have been more with evolving, relatively detailed design and implementation questions and less with relative returns to

different investments, but this may change. The issue of external consistency has to date been less important, but it is important in wider regional debates about the relative returns to input subsidies as compared with other possible investments.

4. Problems and challenges with Benefit Cost Analysis (BCA) of the FISP

Evaluations of the 2006/7 and 2008/9 subsidy programmes, and estimates of benefit costs ratios for other years, used a standard partial equilibrium methodology for estimating the economic benefit cost ratio and fiscal efficiency of the subsidy programme. It was recognised, however, that this method did not take account of wider benefits to poor consumers, from lower food prices and that paradoxically a lower price of maize provided a lower estimate of programme benefit when in fact lower maize prices should lead to wider growth and poverty reduction benefits. This raises concerns with use of these results in comparing estimated returns from subsidies and other investment.

The concerns may be broadly classified into related problems first with data, second with methodology, and third with underlying theoretical questions. These theoretical questions concern the measure and distribution of benefits to different stakeholders (maize producers, consumers, recipients), the scope and spread of benefits and processes of change (affecting maize prices, wage rates, land and labour productivity, the non farm economy), and the valuation of incremental production (using market and import prices).

5. Improving FISP benefit/ cost estimates

Consideration of these theoretical, methodological and data difficulties together with the earlier discussion of purposes and principles for BCA suggests four approaches to improving the BCA of the subsidy programme

1. Continued use of partial equilibrium analysis but with a formal method of price estimation
2. Extension of the method to distinguish between producer and consumer gains and between subsidy recipients and non-recipients
3. Introduction of dynamic effects of growth multipliers
4. Consideration of results with alternative estimates of time periods of return

All of these approaches involve elaboration of the estimation of programme benefits: estimation of programme costs is not conceptually problematic. Total costs incurred in input acquisition (including transport and distribution costs) are added to programme administration costs, with application of shadow exchange rates to non-tradable costs. Costs of acquisition for subsidised inputs that displace unsubsidized inputs are subtracted from the programme costs, as these are simply a transfer from government to the recipients of those subsidised inputs and have little effect on the benefit: cost ratio of the programme (they do, however, affect the Net Present Value (NPV) of the programme, and hence its fiscal efficiency).

5.1. Formal estimation of prices and of consumer and producer gains

Historical data on average annual maize prices and estimated national maize availability (from production, imports, and exports) were used to estimate regression models with different elasticities of demand ranging from 0.22 to 0.51. These allowed estimation of maize supply with the subsidy and, from incremental production estimates derived from yield responses and incremental subsidised input use, supply and prices without the subsidy. The model with demand elasticity of 0.51 provided the most robust results and was also the best regression fit. Import parity prices (from SAFEX with allowance for transport costs) provided an upper limit to the economic valuation of incremental maize production. Gains to producers (subsidy recipients and non recipients) and consumers were then estimated on the basis of changes in real income through changes in sales and purchases prices and volumes. The use of prices estimated from this formal approach raises estimated average returns to the programme over 2005/6 to 2010/11 from an earlier estimate of 1.21 (using analysts price judgements) to 1.47 (see table 2). This is due to the more formal method commonly estimating a

higher without subsidy price, itself partly due to these estimates giving more weight to the possibility of substantially lower price imports from Mozambique.

Separation of relative gains to producers and consumers shows that the balance of gains to consumers relative to producers is lower (a) with more elastic demand and (b) in years where lower domestic production and higher domestic prices relative to import prices lead to more imports, as under these conditions they gain less from price reductions associated with increased production. Subsidy recipients gain more under these conditions as higher prices for incremental production increase their benefits from increased production while all surplus producers suffer less from price falls.

Table 2 Alternative estimates of returns to FISP investments, 2005/6 to 2009/10

		Annual return			Annualised return
	E_D	NB	BCR	FE	BCR
Basic estimate	0.51	59.28	1.47	0.69	1.59
	Original	29.19	1.21	0.30	1.26
Simple multiplier	0.51	104.47	1.61	1.14	1.77
	Original	56.23	1.33	0.51	1.41
Differentiated (a)	0.51	78.37	1.56	1.00	1.71
	Original	38.76	1.32	0.41	1.39
Differentiated (b)	0.51	114.74	1.68	1.31	1.86
	Original	63.16	1.40	0.58	1.50

Averages are simple (unweighted) averages. Annualised return if Benefit Cost Ratio is achieved over 10 months. Fiscal Efficiency = net benefit / fiscal cost.

5.2. Effects of multipliers

There is no standard methodology for building of growth and liquidity multipliers into partial equilibrium analysis, but the estimated economic benefits and costs from partial equilibrium analysis can simply be multiplied by relevant estimates of agricultural multipliers. A number of studies estimate agricultural multipliers of around 1.4 in Sub Saharan Africa and Malawi. Multipliers are therefore introduced initially by multiplying farm benefits and costs by 1.4 and, non-farm costs are multiplied by 1.2 to allow for possible but lower multiplier effects of alternative use of resources invested in the programme This approach is then refined using different multipliers for different types of people, distinguishing between consumers (who are dominated by poor rural people), producers (where less poor rural people dominate in production for sale) and subsidy recipients. For the latter, results are compared with two different multiplier values, the first with a lower value reflecting a bias in subsidy distribution to the less poor, the second with a higher value to investigate possible effects of more effective targeting of subsidised inputs to poorer households. Lower multipliers for less poor people and higher multipliers for poorer people reflect a general pattern observed in growth multipliers, and may also result from dynamic benefits from subsidy receipt and lower prices and higher real incomes relaxing seasonal finance constraints.

Two broad observations can be made from the results from this analysis. First, the results in table 1 show that estimates of net benefits, benefit cost ratios and fiscal efficiencies increase when the effects of multipliers are allowed for, and these increases can be substantial. Second, and not shown in the table, comparison of results from different years shows that since poorer households generally have higher multipliers and account for a higher share of consumption than they do of production, subsidies that lead to domestic price falls will, other things being equal, generally lead to higher returns. Similarly, greater targeting of the poor as subsidy recipients will also generally raise returns.

5.3. Effects of alternative estimates of time periods of return

Previous BCA of the FISP has used benefit cost ratios in a way that implies an annual return on investment. However it might be argued that returns are achieved over a shorter period, less than 12 months from fertiliser purchase and application to harvest. If this is the case then the annualised return on investment will be higher than the simple benefit cost ratio, as shown in Table 2.

6. Conclusions

Application of the principles and purposes for BCA to the development of a more holistic partial equilibrium BCA methodology for the programme has led to

- Higher estimates of returns from investment to the programme
- Results that are more comparable with the estimates to returns from alternative investments

This suggests that with good implementation the programme can provide returns that are comparable with or exceed those achievable from alternative and complementary investments in infrastructure, education and agricultural research. The programme therefore has an important role as a critical element in a strategy of balanced government investments promoting poverty reducing growth in Malawi. High international maize prices, with currently smaller increases in fertiliser prices, should maintain good returns, although there are, of course, also risks of poor implementation and of unfavourable weather and changes in prices that depress returns.

The methodology also reinforces and adds to lessons from previous BCA for FISP design and implementation: returns will be improved by measures that increase yield responses to fertiliser and that reduce displacement. The inclusion of multipliers in the BCA strengthens the importance of all of these issues, as gains from improved efficiency and effectiveness are multiplied. It also adds further weight to the importance of targeting, of ensuring that maize marketing policies allow increased maize production to lower maize prices (as benefits to poorer subsidy recipients and consumers tend to have higher multipliers) and suggests that to maximize linkages and reduce leakages there should be complementary investments in measures facilitating the growth of the non-farm economy and of non-staple agriculture (for example horticulture, legumes and livestock) in response to subsidy-led growth real in real incomes.

The improved methodology does, however, highlight the need for good data on the yield and production effects of subsidised inputs. This is a major challenge. Malawi has excellent data on market prices, and biennial AISP/ FISP evaluation surveys have provided valuable information on targeting and use of subsidised inputs. However continuing difficulties are faced with data on the total number of farm households, on cropping areas and yields, and on yield responses to inputs and agronomic management. Improved data on these variables is critical not just for the evaluation of the FISP, but for much wider policy development, monitoring and evaluation.