EVALUATION OF THE 2010/11 FARM INPUT SUBSIDY PROGRAMME, MALAWI

Impacts of the Farm Input Subsidy Programme in Malawi

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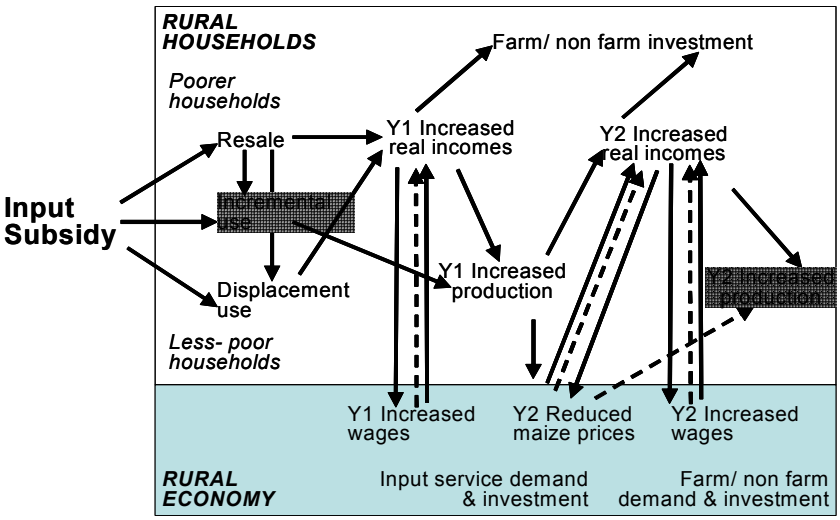
Abstract: This paper focuses on the analysis of the impact of the Farm Input Subsidy Programme (FISP) using national level data and household survey data collected prior to FISP in 2004/05 and data collected in March – April 2011. In this data set 463 households were interviewed in both surveys and similar questions on some of the socio-economic indicators were asked during interviews to enable us to test the impact using a difference-in-difference estimator. We find evidence of economy wide and input market effects of the subsidy programme. The economy-wide effects of the subsidy programme are strong particularly due to lower maize prices and increased *ganyu* wage rates. With respect to input market effects, with 2010/11 conditions and quantities of subsidised fertiliser, a 1 percent increase in subsidized fertilizers reduces commercial demand by 0.15 – 0.21 percent. However, using various welfare indicators, we find mixed results on the direct beneficiary household effects of the subsidy programme from panel data analysis. Overall, there are positive impacts of the subsidy programme although some of the relationships are not statistically significant. The direct beneficiary impacts on food security, food consumption, self-assessed poverty and overall welfare are weak and mixed while there is some statistically significant evidence of positive impacts on primary school enrolment, under-5 illness and shocks. In addition, there is some evidence of positive trends in impact indicators as the number of times a household received the subsidy in the past 6 season increases. The economy-wide effects of the subsidy which arise from higher *ganyu* wage rates, reduced time spent on *ganyu*, availability of maize at local level and lower prices of maize have enabled poor households to access maize when they run out of their own production. Nonetheless, the impact analysis highlights the challenges of targeting and sharing of subsidy among households, which may have implications on the direct beneficiary impacts.

1.0 Introduction

This paper analyses the impact of the Farm Input Subsidy Programme (FISP, previously known as the Agricultural Input Subsidy Programme, AISP) on selected indicators of household welfare. The 2010/11 season marked its sixth year of implementation and some households have had continuous access while others have had intermittent access to subsidized fertilizers. Although the main objective of the farm input subsidy programme is to increase productivity and food security, it plays multiple roles and has the potential to influence other social economic indicators of well-being. Previous evaluations of the FISP have focused on a narrow range of impact indicators and the analysis has largely been based on cross-section data (SOAS et al, 2008; Dorward and Chirwa, 2010b). Furthermore, the analysis of impact of the subsidy programme on maize production and productivity has been marred by the difficulties in obtaining consistent data on area under maize cultivation and maize output based on recall methods and yield sub-plots (Dorward and Chirwa, 2010a). However, apart from productivity and maize production and self assessment of poverty, there are other socio-economic indicators that can be influenced by the availability of food through the subsidy programme. These other indicators include food consumption, schooling and health and resilience to shocks and stresses.

SOAS et al (2008) and Dorward et al (2010) suggest various pathways through which a large scale farm input subsidy programme affects different types of households, different markets and the economy. These effects are classified into effects on the macroeconomic environment (fiscal, monetary, growth and food price effects), effects on input markets (displacement and investments in input supply systems) and rural household impacts (direct beneficiary effects and rural economy-wide effects). SOAS et al (2008) present a framework for understanding the different direct and indirect impacts of input subsidies on different households in a rural economy, as presented in Figure 1. The effects on recipient households arise from the direct beneficiary impacts of the subsidy programme through increased production and incomes from sales of agricultural output, resale of coupons by poor households and displacement use by less poor households.

Figure 1 Understanding household and local economy impacts of input subsidies



Note: dotted lines represent negative effects for less poor maize surplus households
Source: SOAS et al (2008)

The other effects arise from economy-wide impacts owing to the scale of the programme through the price effects – reduced price of food and increase in wages. These economy-wide effects affect both recipients and non-recipient households in the rural economy. The economy-wide impacts can also affect the macroeconomic environment and promote economic growth. The increased incomes arising from direct beneficiary impacts and economy-wide impacts may stimulate further investments and diversification in farm and non-farm activities, with implications on the overall growth of the economy.

These various effects of the farm input subsidy programme depend on the implementation efficiency and the cost effectiveness of the programme and the various shocks and stresses that household experience. At household level, the size of the benefits or subsidy package, the targeting of beneficiaries, the timing of access to the subsidy and access to extension services are critical in realising direct beneficiary benefits from the subsidy programme. SOAS et al (2008) and Dorward et al (2010) highlight specific issues that can affect the direct beneficiary impacts of the subsidy such as targeting (with the better off more likely to receive the subsidy), size of the benefits (with widespread re-distribution of coupons within the village), improvements in the timing of receipts and limited access to extension advice on fertilizer and seed variety use. The

input market and economy-wide impacts also depend on the efficiency and cost effectiveness of the subsidy programme including scale of the programme, procurement, targeting and distribution of inputs. For instance, reduced maize prices and increased wage rates may kick-start growth in the rural economy while poor targeting may lead to displacement of commercial sales of farm inputs and exclusion of the private sector in the implementation of the subsidy programme may reduce private investment in input supply systems. SOAS et al (2008) and Ricker-Gilbert et al (2010) find evidence of displacement of commercial sales of fertilizers due to the subsidy programme.

The paper is organized into five sections. In the next section, we document the methodology for evaluating the impact of the subsidy programme on various socio-economic indicators. Section 3 analyses the impacts of subsidies on various indicators, including indicators of the economy-wide, input markets and direct beneficiary household effects of the subsidy programme. Section 4 focuses on the impact analysis mainly based on the life stories from selected beneficiary households. Finally, we offer concluding remarks.

2.0 Methodology

2.1 Data Sets

With the advantage of periodic evaluation of the subsidy programme, the design of the third Farm Input Subsidy Survey (FISS3) in 2011 incorporated questions that were also asked to same households in the second Integrated Household Survey (IHS2) in 2004/05. This allows us to compare the same households, with and without subsidies since the 2005/06 season, and provides an opportunity to evaluate the impact of the subsidy programme on direct beneficiary households over time. The FISS3 also tracked access to fertilizer subsidy since the programme started, and this has enabled us to control for the number of times the household has had access to fertilizer subsidies between 2005/06 and 2010/11 seasons.

The study uses both quantitative and qualitative data from the FISS3 conducted between March and April 2011. In the quantitative approach, data was collected from 760 households from eight districts based on a sub-sample of households interviewed in 2008/09. Most of the households, 61 percent, were also interviewed in 2004/05 in the IHS2. The FISS3 questionnaire, as with the previous FISP evaluations, was derived from the IHS2 questionnaire. However, the difference with the previous evaluations is the inclusions of modules on education, health and food consumption in order to evaluate some of the other benefits of the subsidy programme on household welfare. Households that were interviewed in 2008/09 who were not available were replaced with younger and newly forming household in order to increase the younger household head representation in the sample. In the qualitative approach, data was collected through 8 focus group discussions, 24 key informants interviews and life histories (for 64 households) regarding vulnerable groups in 8 districts.

The analysis of the quantitative data is based on the categorisation of households into panel households interviewed in both IHS2 and FISS3 and households that were only interviewed in FISS3. The other dimension in the analysis is the number of times the household has benefited from the subsidy programme since it started in 2005/06. Table 1 presents the distribution of the sample by survey and number of times households have

had access to fertilizer subsidy.

Table 1 Distribution of sample by panel and access to fertilizer subsidy

Number of times accessing subsidy since 2005/06	Panel (IHS2 & FISS3) Households		Non-Panel (FISS3 only) Households		All Sample Households	
	Number	Percent	Number	Percent	Number	Percent
0	19	4.19	16	5.46	36	4.69
1	42	9.06	26	8.82	69	9.03
2	35	7.48	48	16.30	81	10.64
3	33	7.22	31	10.48	68	8.88
4	45	9.63	30	10.22	73	9.59
5	80	17.22	44	14.69	117	15.44
6	209	45.21	101	34.03	317	41.72
N	463	100.00	297	100.00	760	100.00

Note: Weighted figures

Three groups are evident from the distribution of the households: never have had access to fertilizer subsidy (no access), had access to fertilizer subsidy at least five times in six seasons (intermittent access) and had access to subsidy six times (continuous access). In the panel households, 4.2 percent have never had access, 50.6 percent had intermittent access and 45.2 percent of households had continuous access to fertilizer subsidy. In the non-panel households, 5.5 percent have never had access, 60.5 percent had intermittent access and 34 percent of households had continuous access to fertilizer subsidy. Overall, 53.6 percent of households had intermittent access, 41.7 percent had continuous access and only 4.7 percent had never had access to fertilizer subsidies.

2.2 Methods of Analysis

The analysis of the impact of the subsidy programme is categorized into three: economy-wide effects, input market effects and direct beneficiary household effects.

2.2.1 Economy-wide Impacts

The analysis of economy-wide impacts is based on the trends of selected macroeconomic variables such as gross domestic product, agricultural output, general price levels and the fiscal balance; and household level data on maize prices and rural wages. In addition, the information from focus group interviews and key informants is used to confirm some of the rural economy-wide impacts of the subsidy programme. It is not possible to quantify direct causative effects of the subsidy, but to evaluate the strength and patterns of association between subsidy implementation, its direct effects, and wider changes.

4.2.1 Input Market Impacts

This analysis is based on information from the household survey and the qualitative data and focuses on trends in purchases of commercial fertilizers and the impact of the subsidy programme. We use a regression based approach to estimate the demand in commercial fertilizers using panel households and use qualitative interview data to triangulate the econometric and descriptive results. There may be selection bias in the household decision to participate in the commercial fertilizer market. We therefore use a two-step estimation procedure. In the first stage, we estimate the probit model of participation in the commercial fertilizer market using distance to the main road (as the

identification variable) and household characteristics and quantity of subsidized fertilizers received by the household. In the second step, we estimate the demand for commercial fertilizers controlling for the selection bias using the Inverse Mills ratio obtained from the first stage. Two sub-samples are used to estimate the second stage equation: panel households that initially bought commercial fertilizers in IHS2 and panel households that bought commercial fertilizers in either IHS2 or FISS3. The null hypothesis is that subsidized fertilizers do not reduce the demand for commercial fertilizers at household level.

2.2.3 Direct Beneficiary Impacts

This analysis is based on household survey data and qualitative interviews with selected beneficiaries. The quantitative analysis of the impact of the subsidy programme is based on households that were interviewed in both the IHS2 and FISS3 using panel regression analysis and on all households interviewed in FISS3 using cross-section regression analysis. The discussion is enriched by the qualitative interviews conducted with communities in the FISS3. In the quantitative analysis of impact of the subsidy programme on various socio-economic indicators, households are categorized into five groups represented by dummy variables: never had access (base category), accessed 1 – 2 times, accessed 3 – 4 times, accessed 5 times and accessed 6 times (continuously). It should be noted, however, that this categorisation ignores the first the timing of access except for the never had access households and the continuous access households and second the quantity accessed (which varied considerably with, for example, 41% of all sampled households receiving coupons for redemption of 50kg fertiliser in 2010/11 and 33% of households receiving coupons for redemption of 100kg fertiliser of fertiliser or more).

For the panel data analysis, we employ a standard difference-in-difference estimation strategy using the following specification:

$$Y_{it} = \alpha_i + \delta_t + \sum_{k=2}^{k=5} \beta_k(\delta_t * FISP_k) + X_i + \varepsilon_{it} \qquad (1)$$

where *i* is the individual household, *t* is the wave of the survey (2004/05 and 2010/11), k indexes the household categorization of access to subsidies over the past 6 years, α_i are individual fixed effects, δ_t is a dummy variable equal to 1 for the second round of the survey (2010/11), and $(\delta_t * FISP_k)$ is the interaction dummy that is equal to 1 only for households that received fertilizer subsidy in access category *k,* X is a vector of household characteristics. The coefficient $\hat{\beta}$ gives the impact of the subsidy programme on household socio-economic indicators comparing before and after access to the subsidy programme. The panel analysis is based on the full panel sample (463 households) and a sub-sample of panel households that were identified as poor based on per capita expenditure in the IHS2 (227 households). The latter allows us to investigate the impact of the subsidy programme on households that had the same initial condition prior to the subsidy programme. For the cross-section analysis, we use the same model as (1) but exclude δ_t in the specification and use data for 760 households. The estimated coefficient $\hat{\beta}$ gives the impact of the subsidy programme on household socio-economic indicators in 2010/11 only. In cases where the dependent variable is a dummy variable in the cross-section analysis, we estimate the model using probit regression analysis.

Table 2 presents the various indicators that have been selected to test various hypotheses

on the direct beneficiary impacts of the subsidy programme. In addition, to the hypothesized relationship, we also expect the subsidy to have larger impacts on households that have had access to subsidized fertilizers in all the past 6 seasons compared to those that have had less access. This implies that there should be a positive trend in the value of the coefficients of times of receipt of subsidy as the frequency of receipt increases from 1 to 6 times. There are, however, two main caveats to the household level analysis of direct beneficiary impacts. First, most of the indicators are subjective assessments by households; hence with the difficulties of calibration and differences in the timing of interviews, caution must be exercised in interpreting the panel level results. Second, if economy-wide effects are much stronger, such that the subsidy benefits all households, the impacts at household level may be weak regardless of direct benefits or number of times of access to subsidized fertilizers in the past 6 agricultural seasons. In this case the econometric results may not be able to pick these small changes.

Table 2 Beneficiary household level impact indicators and hypotheses

Welfare Category	Indicators	Data	Impact: Alternative Hypothesis
Food security	1) Adequacy in food consumption in past month	IHS2&FISS3	Positive
	2) Adequacy in food consumption in past year	FISS3	Positive
	3) Food consumption score	FISS3	Positive
	4) Coping strategy index	FISS3	Negative
	5) Number of months before food stocks run out	FISS3	Positive
	6) Amount of maize grain purchased after stocks run out	FISS3	Negative
	7) Amounts consumed of food crops in past week	IHS2&FISS3	Positive
Subjective Poverty	1) Subjective assessment of poverty status	IHS2&FISS3	Positive
	2) Subjective overall well-being assessment	IHS2&FISS3	Positive
Schooling and Health	1) Primary school enrolment at household level	IHS2&FISS3	Positive
	2) Incidence of under-5 illness	IHS2&FISS3	Negative
Shocks and Stresses	1) Number of shocks experiences by household	IHS2&FISS3	Negative
	2) Incidence of severe agricultural-related shocks	IHS2&FISS3	Negative

3.0 Impacts of the Farm Input Subsidies

3.1 Economy-wide Effects

The macroeconomic environment since the introduction of the farm input subsidy programme has remained relatively stable. Table 3 shows trends in some of the macroeconomic indicators between 2005 and 2010. From 2005 up to 2008 the economy witnessed increases in the both agricultural and gross domestic product. However, since 2009, the economy has witnessed a decline in the growth rate of the economy but it has still been growing at above 6 percent. Agricultural output grew by 6.6 percent in 2010 compared to 10.4 percent in 2009. The reduction in agricultural growth rates have been attributed to the dry spell that hit some parts of the country. The overall growth rate in gross domestic product in 2010 was largely helped by the 53 percent growth rate in the mining sector, implying that growth could have been much lower without the emerging mining sector. Nonetheless, both the growth rates in gross domestic product and

agricultural output have been partly attributed to the subsidy programme and the good rains that the country has witnessed over the past 6 agricultural season.

Table 3 Macroeconomic performance indicators, 2005 – 2010 (%)

Indicator	2005	2006	2007	2008	2009	2010
Real Agricultural Growth	-7.8	12.3	12.3	11.8	10.4	6.6
Real GDP Growth	3.3	6.7	8.6	9.7	7.7	6.7
Inflation	15.4	13.9	8.0	8.7	8.4	7.4
Deficit/GDP Ratio (actual)	-0.4	-1.4	-4.0	-6.3	-5.5	1.6
Deficit/GDP Ratio (budget)	-2.6	-1.5	-1.8	-7.8	-8.2	4.0
Debt/GDP ratio	-	8.2	8.2	17.4	15.1	15.7

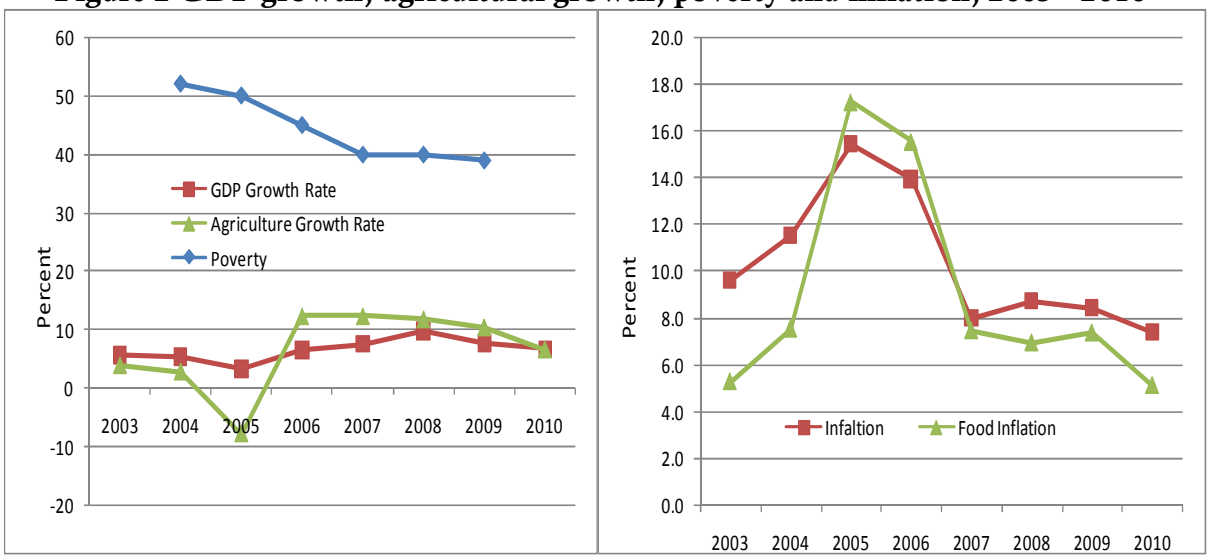
Source: Reserve Bank of Malawi, *Financial and Economic Review, 22 (4)*, 2010

The deficit/GDP ratio in the fiscal budget has been worsening particularly up to 2009 from -1.5 percent in 2006 to -8.2 percent in 2009. However, based on projected actual figures, there is expectation of a surplus of 1.6 percent of gross domestic product in 2010. More worrying is the increase in the indebtedness of the country from 8.2 percent of gross domestic product in 2006 to 15.7 percent of gross domestic product in 2010. The peak in domestic debt appears in 2008/2009, which also witnessed high fiscal deficit/GDP ratio and this was also the year the subsidy cost was 6.6 percent of gross domestic product and the subsidy budget was over-spent by about 87 percent, partly due to higher fertilizer prices and expansion of the programme (Dorward et al, 2010).

There has also been price stability over the period of implementation of the farm input subsidy, with inflation on a declining trend from 15.4 percent in 2005 to a single digit level of 7.4 percent in 2010, although maize prices rose dramatically from early 2008 to early 2009, before falling back in mid 2009 to 2010. Figure 2, right panel, shows that inflation continued to fall owing to the low prices of maize that have been experienced in the last season. Maize prices account for a significant proportion of the food component of the consumer price index, and reduction in maize prices have exerted downward pressure on the general price level and food inflation. Reductions in the price of maize in 2006/7 and 2009/10 are attributed to the economy-wide effect of the subsidy programme that has improved availability of maize in the economy[1]. These positive macroeconomic developments have also been accompanied by reduction in the projected incidence of poverty as shown in figure 2, left panel. Since 2006, the poverty rate based on the model-based prediction has fallen from 52 percent to 39 percent in 2009.

[1] It is not clear why maize prices rose in 2008/9 – and without apparent hardship for the poor – probably due to a combination of rising *ganyu* wage rates and disruption of a thin market by official export of over 300,000MT of maize in late 2007 when it was thought that maize stocks were higher than they actually were (Dorward and Chirwa, 2011).

Figure 2 GDP growth, agricultural growth, poverty and inflation, 2003 - 2010



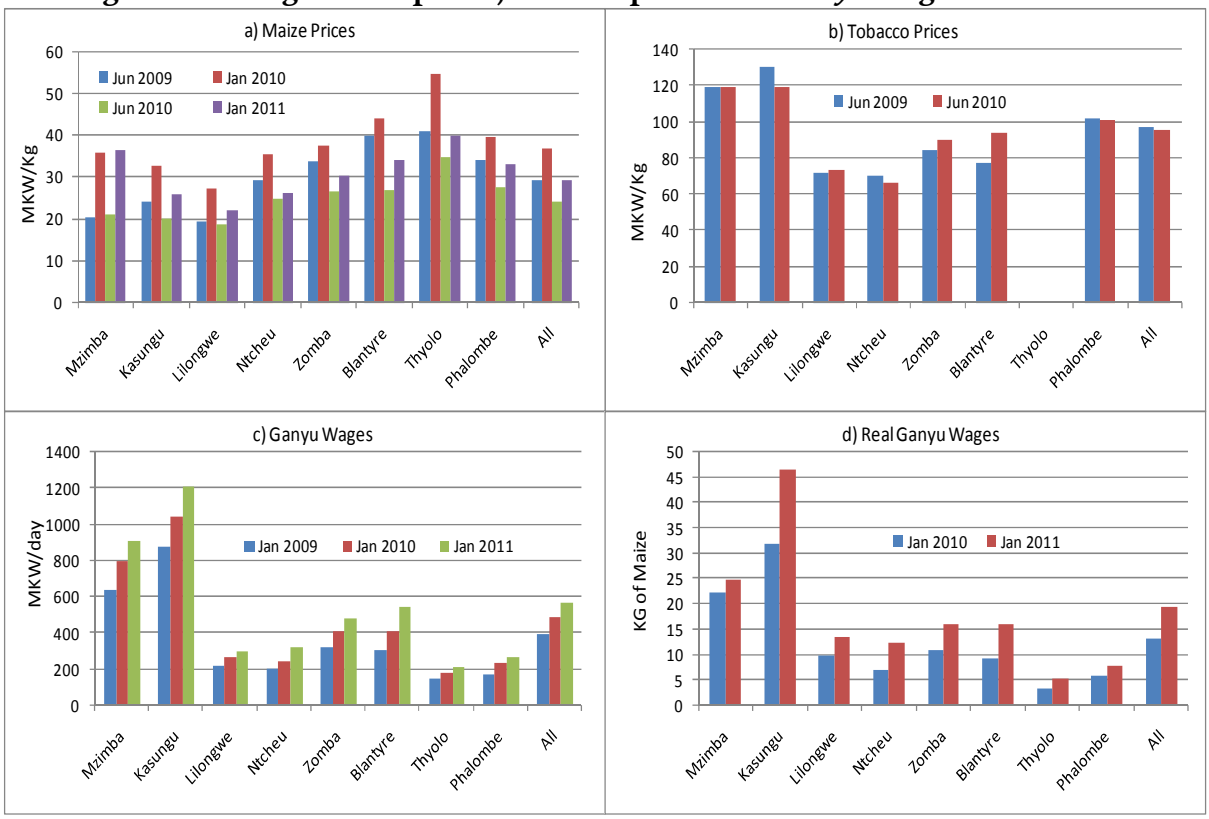
Source: Computed by authors based on data from Reserve Bank of Malawi and NSO

Some of these national level developments were confirmed from the household survey and qualitative interviews data. Figure 3 shows the levels of maize and tobacco prices and *ganyu* wage rates between 2009 and 2011. With respect to maize prices, overall the prices at which households buy maize has been below MK30 per kilogram except for January 2010 (figure 3a). Generally, Blantyre and Thyolo experienced higher maize prices while Lilongwe and Kasungu experienced lower maize prices. Tobacco prices generally fell between 2009 and 2010 (figure 3b), although in Blantyre and Zomba households reported improved tobacco prices. With respect to wages (figure 3c), there is an increase in wages over time as reported by households, and these increases have occurred in all the districts surveyed. In terms of levels, in Mzimba and Kasungu households reported the highest wage rates while Thyolo and Phalombe households reported the lowest wage rates.

These wage rates and maize price developments were also widely reported in focus group discussions and life histories of some of the beneficiaries. In most life histories of beneficiaries, among poor households, engaging in *ganyu* to earn income to purchase food is a common strategy and such improvements in wages and reduction in maize prices made maize more affordable even for poor households. This is confirmed in figure 3d which shows real increases in *ganyu* wages in terms of its maize grain purchasing power. Overall, the maize purchasing power of daily *ganyu* wages increased by 47 percent between January 2009 and January 2010, with the highest increase of 80 percent in Ntcheu and lowest increase of 34 percent in Phalombe. Since these increases in real *ganyu* rates benefit recipient and non-recipient households, the results suggest that the rural economy-wide benefits of the subsidy programme are very strong. These high wages have also enabled poor households to spend less time on *ganyu* in order to earn income adequate to purchase food whenever their own stock run out. This reduction in time spent on *ganyu* was universally reported in focus group discussions and life histories of beneficiary households. For earlier years of the FISP, survey and FGD work in 2006/7 demonstrated similar processes of falling maize prices, rising wage rates, and falling time spent on *ganyu* from 2005 to 2007. Surveys and FGDs in 2009 suggested that from 2007 to 2009, rising maize prices and constant nominal *ganyu* rates led to some fall

back in real *ganyu* rates. This has then been strongly reversed from 2009 onwards as discussed above.

Figure 3 Average maize prices, tobacco prices and *Ganyu* wages 2009 - 2011



Source: Computed by authors based on FISS3 survey data

3.2 Impacts on Farm Input Markets

The farm input subsidy programme can have several impacts on the input market system depending on the scale, targeting and other implementation modalities. On one hand, a poorly targeted large scale programme results in displacement of commercial sales and introduces disincentives for private investments in input markets. On the other hand, a well targeted programme can stimulate additional demand for commercial fertilizers among subsidized households by improving productivity and profitability of their farming activities and their ability to finance fertiliser purchases. Table 4 shows the quantity of subsidized and commercial fertilizers acquired by households in 2009/10 and 2010/11 seasons by IHS2 poverty status compared with commercial fertilizers in the IHS2. Among poor households the average quantity of subsidized fertilizers declined from 54 kilograms in 2009/10 to 47 kilograms in 2010/11 while commercial fertilizers increased from 48 kilograms to 61 kilograms. A similar trend is observed among non-poor households, and may be related to economy wide impacts of the programme. The data also shows that both poor and non-poor households supplement subsidized fertilizers with commercial fertilizers but among the poor the higher the number of seasons a household benefits from the subsidy the lower the supplementation with commercial fertilizers. No consistent pattern emerges with respect to non-poor households that are subsidized.

Table 4 Quantity of subsidized and commercial fertilizers by IHS poverty status (kg)

Times of Subsidy Access	Poor Households in IHS2						Non-Poor Households in IHS2					
		Subsidy		Commercial				Subsidy		Commercial		
	N	2009	2010	2004/5	2009	2010	N	2009	2010	2004/5	2009	2010
0	4	0	0	82	58	55	11	0	0	691	132	128
1	17	3	12	37	61	79	18	10	17	123	246	250
2	15	44	20	176	126	92	13	32	17	221	157	181
3	18	52	36	68	29	80	23	35	44	174	98	99
4	22	59	50	130	54	70	22	49	39	79	141	151
5	37	51	38	52	31	51	37	54	40	162	72	102
6	114	70	66	72	40	51	112	75	74	116	61	63
All	227	54	47	78	48	61	236	53	49	165	100	109

Source: computed by authors based on IHS2 and FISS3 data

A comparison of the 2009 and 2010 commercial purchases with 2004/05 purchases shows a mixed picture among different households. On one hand, among the category of poor households only those that have had access to the subsidy over 1 season and 3 seasons are on average purchasing more in 2010 than in 2004/05. On the other hand, among the non-poor households only for households that have had access to the subsidy in the past 2 and 4 seasons do we witness purchases above the 2004/05 levels. This suggests some crowding out of commercial fertilizer sales due to the subsidy programme, although the decline in commercial purchases also occurred among households that have never received subsidized fertilizers. However, it should also be noted that the average prices of commercial fertilizers have substantially increased from MK37 per kilogram in 2004/5 to MK97 per kilogram in 2010/11, an increase of 162 percent over the period; this might have dampened the demand for commercial fertilizers.

Table 5 presents regression results of the factors that affect participation in the commercial fertilizer market and the demand for commercial fertilizers. Model (1) shows that the probability of participation in the commercial fertilizer market in 2002/03, 2003/04 and 2010/11 is positively influenced by male headship of household, number of adult equivalent members, years of education of household head, fertilizer prices, initial access to credit and value of assets. The probability of participation falls significantly with quantity of subsidized fertilizers and poverty. In addition, participation is higher in the central region than in the southern region and higher in 2002/03 and 2003/04 seasons than in 2010/11 season. However, we find a positive relationship between the price of fertilizers and participation in commercial fertilizer market as was the case in Ricker-Gilbert et al (2010). The marginal effect is just 1.7 percent, implying that households that decide to participate in the commercial market do so regardless of small increases in prices. The other unexpected result is the distance to the main road where the coefficient is positive. Nonetheless, given the presence of fertilizer markets in remote areas, distance to the main road maybe a poor proxy for the transaction costs to input markets and its marginal contribution to the probability of participation is less than 1 percent. Model (2) estimates the demand for commercial fertilizers for households that bought commercial fertilizers in the IHS2 only. This informs us of the buying behaviour of these households as a result of the FISP. The results show that demand for commercial fertilizers is positively associated with number of adult equivalents, years of education of household head, maize prices, initial access to credit and value of assets; and it is negatively associated with quantity of subsidized fertilizers and poverty. With

respect to the coefficient of quantity of subsidized fertilizers, the elasticity shows that a 1 percent increase in subsidized fertilizers reduces demand for commercial fertilizers by 0.39 percent. This suggests that subsidized fertilizers displace commercial fertilizer purchases among those that purchased fertilizers in 2002 – 2004 seasons. These households accounted for 54.1 percent of the total subsidized fertilizers in the sample, and using the relative shares of subsidized fertilizers we obtain weighted elasticity of -0.21, as the overall effect of subsidized fertilizers on commercial demand. However, we find a positive coefficient of average district fertilizer prices, which is unexpected, but it is statistically insignificant. This maybe partly due to the high level of aggregation of fertilizer prices from survey data that might have dampened the changes in fertilizer prices and as observed earlier that small changes in prices do not hamper participation in the fertilizer market for households that decide to participate due to the perceived benefits of applying fertilizers.

Table 5 Factors influencing participation and demand for commercial fertilizer

Independent variables	(1) Participation in commercial fertilizer market *(Probit)*		(2) Demand for commercial fertilizers if bought in IHS2 *(Tobit)*		(3) Demand for commercial fertilizers if bought in IHS2/FISS3 *(Tobit)*	
	dF/dx	z	elasticity	z	elasticity	z
Inverse Mills ratio	-	-	0.4310	0.57	0.5489	1.60
Age of HH head (years)	-0.0032	-0.95	0.4340	0.72	-0.1807	-0.65
Male HH head *	0.2565	2.03[b]	0.0243	0.06	-0.0117	-0.06
Number adult equivalents	0.0697	2.46[b]	2.4883	3.66[a]	1.2548	4.89[a]
Years of education HH head	0.0576	3.46[a]	0.9013	2.19[b]	0.4195	2.32[b]
Extension advice on fertilizers	-0.1432	-0.90	0.0118	0.16	0.0045	0.13
Land in hectares	-0.0037	-0.72	-0.0202	-0.61	0.2739	3.84[a]
Quantity of subsidized fertilizers in kg	-0.0092	-5.28[a]	-0.3904	-1.91[c]	-0.2912	-2.92[a]
Poor household self-assessment *	-0.4415	-1.75[c]	-1.3844	-2.07[b]	-0.9027	-3.02[a]
Average district maize prices – May-Oct	0.0177	0.98	4.3367	2.58[a]	1.2089	1.52
Fertilizer prices at EA level	0.0168	4.00[a]	0.6593	0.54	0.1065	0.17
Initial Access to credit in 2004/05	0.7121	3.64[a]	0.2965	2.52[a]	0.1316	2.52[a]
Business enterprise (0/1)	0.0248	0.22	-0.2892	-1.13	-0.0930	-0.75
Distance to main road in km	0.0007	0.21	-	-	-	-
Value of assets in MK	0.0000	3.51[a]	0.0618	3.20[a]	0.0360	4.25[a]
Participation in labour market (0/1)	-0.0161	-0.15	-0.1651	-1.23	-0.1153	-1.71[c]
Received remittances *	-0.0394	-0.36	-0.2504	-1.01	-0.1113	-0.95
North *	0.0404	0.20	0.3193	2.67[a]	0.2008	4.31[a]
Centre *	0.3286	2.02[b]	0.8551	2.98[a]	0.3700	3.27[a]
2002/03 season *	0.7935	2.27[b]	0.7005	1.81[c]	0.3001	1.51
2003/04 season *	0.7665	2.14[b]	0.5197	1.47	0.1258	0.69
Wald chi2(20)		108.58		148.22		179.81
Prob > chi2		0.000		0.000		0.000
Number of observations		926		564		533
Number of households		463		282		353

Notes: These are random effects models. (*) dF/dx and elasticities are for discrete change of dummy variable from 0 to 1. Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively.

Model (3) uses a sub-sample of households that purchased commercial fertilizers either in IHS2 or/and FISS3, and captures those households that might have entered the commercial market during the subsidy period – hence those that did not buy in IHS2 but bought commercial fertilizers in FISS3. If the subsidy encourages purchase of commercial fertilizers among some households, for example those that see the benefits of applying subsidized fertilizers, then we expect the elasticity with respect to subsidized

fertilizers to fall in model (3) compared to model (2). The coefficient of subsidized fertilizers shows an elasticity of -0.29, implying that a 1 percent increase in subsidized fertilizers leads to a 0.29 percent reduction in the demand for commercial fertilizers among those that purchased commercial fertilizers in either IHS2 or/and AISPS. The weighted elasticity using relative shares of subsidized fertilizers is -0.15 for the whole sample of panel households. This elasticity is lower than the -0.39 observed for panel households that initially bought commercial fertilizers in IHS2. The demand for commercial fertilizers also falls for poor households and households that participate in labour markets but increases with number of adult equivalents, education, land holding size, average maize prices and value of assets. The demand is also much higher in the central region and northern region compared with the southern region, possibly due to the cultivation of tobacco in the central and northern region.

3.3 Direct Beneficiary Household Impacts

3.3.1 Household Food Security

An immediate reported effect of the farm input subsidy programme on beneficiary household welfare is to improve food availability and security at household level. Several indicators are used to measure the impact of the subsidy programme including adequacy in food consumption, food consumption and coping strategy indices and amounts of various foods types consumed by the household. Households were asked in both IHS2 and FISS3 whether their food consumption in the past month of the survey was adequate or not. The null hypothesis is that the extent of subsidization does not statistically affect household food security indicators. Table 6 shows the results from the difference-in-difference estimation. Both the panel and cross-section analysis show that access to the subsidy does not significantly affect the food security situation of households, although the panel analysis shows that the proportion of households that had adequate food consumption increased between 2004/05 and 2010/11. We do not therefore reject the null hypothesis that access to fertilizer subsidy does not significantly affect food security indicators. With respect to number of times the household has had access, we find that on average the higher the number of times of access the more likely the household is to have adequate food consumption.

However, in the panel analysis we find that female headship, age of household head and education of household head positively and significantly affect improvements in household self assessment of food security. In the cross-section analysis, we find household assets, land, age of household and education of household head significantly associated with self assessed food adequacy. The analysis of qualitative data revealed that in most focus group discussions communities reported availability of food while for most life histories the sentiments were that the subsidy has enabled households to produce a bit more food compared to situations without subsidy.

Table 6 Probit regression estimates of impact of subsidy receipt on food consumption

Dependent variable = 1 if household had adequate or more food in past month of survey	Panel Households *Random Effects*		FISS3 Households *Probit*	
	dF/dx	z	dF/dx	z
Dummy 2011 for survey*	0.2608	0.59	-	-
Dummy received subsidy 1 – 2 times*	-0.4921	-0.94	-0.0563	-0.45
Dummy received subsidy 3 – 4 times*	-0.3722	-0.81	-0.0161	-0.13
Dummy received subsidy 5 times*	-0.0899	-0.19	-0.0091	-0.08
Dummy received subsidy 6 times*	0.0507	0.12	0.0508	0.46
Durable assets (000 MK)	0.0054	0.28	0.0131	3.66[a]
Logarithm of land (ha)	0.0382	0.65	0.0368	1.75[c]
Dummy male-headed household*	-0.2019	-1.71[c]	-0.0335	-0.81
Age of household head (years)	0.0096	2.71[a]	0.0018	1.66[c]
Years of education HH head (years)	0.0717	3.73[a]	0.0172	2.79[a]
Pseudo R-squared		-		0.0819
Wald chi-squared		47.70		52.20
Prob > chi-squared		0.000		0.000
N		897		749
Mean of dependent variable 2004/05	*0.4480*		-	
Mean of dependent variable 2010/11	*0.5558*		*0.5806*	

Notes: (*) dF/dx is for discrete change of dummy variable from 0 to 1. Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Standard errors obtained through bootstrapping at 50 repetitions.

Based on questions in the FISS3 only, we construct three indicators of food security: the households' own assessment of the annual food situation, the food consumption scores and the coping strategy index. First, households were asked to indicate the adequacy in food consumption in the past 12 months of the survey. We created a dummy variable equal to 1 for households that had adequate or more than adequate food consumption in the past year. Secondly, following WFP (2008) we use the Food Consumption Score (FCS) which is a composite score based on dietary diversity, food frequency and relative nutritional importance of different food groups consumed in the household during the previous seven days. The higher the score the more food secure is the household. The maximum score is 112. Households with a score below 21 are food insecure; those with 21.5 – 35 are borderline cases and those with more than 35 are food secure households. Thirdly, following Maxwell and Caldwell (2008), the frequency of use of coping strategies is combined with severity weights to generate the Coping Strategy Index (CSI). The CSI is a proxy for household food security interpreted such that the higher the CSI the more a household has to cope; the more food insecure is the household. The CSI has a maximum score of 56. Some of the strategies in the CSI include relying on less preferred foods, borrowing food or relying on friends and relatives, limiting portion sizes, restricting consumption by adults in favour of small children, and reducing the number of meals eaten per day.

Table 7 shows that using these three indicators there is no statistical evidence that the number of times a household has had access to FISP since 2005/06 affects the food security situation of households. We cannot reject the null hypothesis in all the three models that there is no statistically significant relationship between the subsidy and household food security indicators. Overall, we find a negative relationship between access to subsidy and food consumption in the past year, but there is a positive trend of the number of times of access to subsidy and food consumption in the past year. With respect to food consumption score, we find a negative relationship with access to subsidy and a mixed trend with respect to the number of times the household have access to the

subsidy. In the coping strategy index results, the coefficients of the dummies for access to subsidies are negative, which is expected, but they are statistically insignificant and with very low t-ratios. In terms of the effect of the number of times household accessed subsidies, we find a negative trend with households that have accessed the subsidy more being more unlikely to use coping strategies. The analysis of a sub-sample of households that were identified as poor based on per capita expenditure in the IHS2 yielded similar results, suggesting that among the poor access to the subsidy programme did not significantly improve the food security of households.

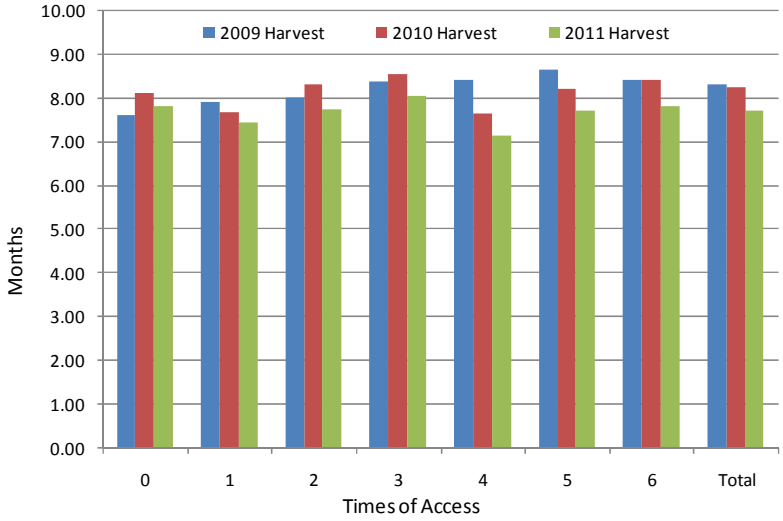
Table 7 OLS regression estimates of subsidy receipt and 2010/11 food security

Dependent variable	*=1 if Adequate Food Consumption past year*		*Food Consumption Score*		*Coping Strategy Index (reduced)*	
	dF/dx	z	dF/dx	z	dF/dx	z
Dummy received subsidy 1 – 2 times*	-0.1648	-1.51	0.4093	0.13	-0.5755	-0.35
Dummy received subsidy 3 – 4 times*	-0.0579	-0.55	-2.0672	-0.68	-0.5940	-0.35
Dummy received subsidy 5 times*	0.0636	0.63	0.0006	0.00	-0.9161	-0.55
Dummy received subsidy 6 times*	0.0456	0.47	-0.2678	-0.09	-1.7375	-1.10
Durable assets (000 MK)	0.0144	3.51[a]	0.0091	6.49[a]	-0.0009	-1.83[c]
Logarithm of land (ha)	0.0706	2.96[a]	2.0996	2.67[a]	-0.4833	-1.38
Dummy male-headed household*	-0.0147	-0.31	1.3772	0.83	-1.7049	-2.15[b]
Age of household head (years)	0.0001	0.07	-0.0722	-1.81[c]	-0.0055	-0.32
Years of education HH head (years)	0.0174	2.80[a]	0.9348	4.74[a]	-0.3367	-4.80[a]
R-squared		0.1055		0.0977		0.0657
F		60.94		15.95		5.23
Prob>F		0.000		0.000		0.000
N		749		749		749
Mean of dependent variable in 2010/11	*0.5289*		*49.88*		*4.479*	

Notes: (*) dF/dx is for discrete change of dummy variable from 0 to 1. Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Robust standard errors based on weighted regressions.

Figure 4 presents the average number of months before households run out or expected to run out of their own maize production by the frequency of access to subsidized fertilizers based on the data collected in the FISS3. Overall, the average number of months before own food production run out before the next harvest are 8.31, 8.22 and 7.69 following the 2009, 2010 and expected 2011 harvests, respectively. There also no major differences among different households distinguished by the frequency of access to subsidized fertilizers. However, in all categories, households expect a decrease in the number of months their own 2010/11 production will run before the next harvest compared to 2010 harvest.

Figure 4 Average months of stock out of own maize production



Source: Computed by authors based on FISS3 survey data

We also assess the food security impact of the frequency of receipt of the subsidy using the number of months before households run out of their own production from the 2010 harvest before the 2011 harvest and the amount of maize bought to meet their food requirements. Table 8 shows that as regards receipt of the subsidy, there is positive relationship between receipt of subsidy and number of months before own food stocks run out, but the relationship is not statistically significant. In addition, there is a positive association with the number of months own stock last (with higher coefficients as the frequency of access increases). It appears, however, that the frequency of access to fertilizer subsidy matters with respect to quantity of maize purchased by those households that run out of own maize stocks. All the coefficients of the dummies for access to fertilizer subsidies are positive and statistically significant at the 5 percent level, although our expectation was a negative relationship. Interestingly, the higher the frequency of receipt of fertilizer subsidies the lower the amounts of maize purchased by the household, a reflection that those that have always been on subsidy also have their maize last marginally longer. This may suggest some positive effect of the subsidy programme on food availability.

Table 8 OLS regression estimates of subsidy receipt and food adequacy and purchases

Dependent variable	*Number of months 2010 food last before 2011 harvest*		*Amount maize grain in kilograms bought in 2010/11*	
	β	t	β	t
Dummy received subsidy 1 – 2 times	0.0925	0.15	163.77	2.26[b]
Dummy received subsidy 3 – 4 times	0.1935	0.32	97.43	2.06[b]
Dummy received subsidy 5 times	0.2333	0.38	92.58	3.25[a]
Dummy received subsidy 6 times	0.2886	0.51	75.19	2.77[a]
Durable assets (000 MK)	0.0008	0.92	-0.0820	-0.62
Logarithm of land (ha)	0.6955	4.58[a]	5.9869	0.43
Dummy male-headed household	0.3155	1.10	54.073	1.41
Age of household head (years)	0.0058	0.76	1.2587	1.06
Years of education HH head (years)	0.0484	1.30	-4.2525	-1.56
Constant	7.4650	9.86[a]	3.9622	0.07
R-squared		0.0787		0.0111
F		3.9		1.99
Prob>F		0.000		0.039
N		481		437
Mean of dependent variable in 2010/11	*8.3190*		*178.84*	

Notes: Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Robust standard errors based on weighted regressions.

Both the IHS2 and FISS3 asked households to indicate the amount of foods consumed in the past 7 days of the survey. However, the analysis presented only relates to the cross-section analysis of the FISS3 survey. The panel models on changes in food consumption were unsatisfactory – in all the panel models the hypothesis that all the coefficients except the constant are equal to zero could not be rejected. The panel results suggest that food consumption between 2004/05 and 2010/11 did not change significantly between the periods and among subsidized households. One reason is that the consumption data in 2004/05 survey relate to harvest from the 2002/03 and 2003/04 harvests which were good years in terms of agricultural production. Table 9 shows that the frequency of subsidy access is positively related to consumption of maize and bananas in the past seven days of the survey. In the case of maize consumption, the strongest evidence appears to be among households that have had access five or six times, with the coefficients being statistically significant at the 1 percent level. There is an overall negative relationship between receipt of subsidy and consumption of rice, although such a relationship is not statistically significant. However, rice consumption does vary among households with different frequencies of access to subsidized fertilizers and the trend is positive. The consumption of bananas, however, varies with the frequency of access to subsidized fertilizers, with most coefficients being statistically significant at the 1 percent level. The average amount of bananas consumed increases with the frequency of access to fertilizer subsidies only up to 5 times of access; hence there is an increasing trend of banana consumption as the frequency of subsidization increases.

Table 9 OLS regression estimates of subsidy and cereals/fruit consumption in 2010/11

Dependent variable	*Amount maize consumed past week (Kg)*		*Amount rice consumed past week (Kg)*		*Amount banana consumed past week (Kg)*	
	β	t	β	t	β	t
Dummy received subsidy 1 – 2 times	2.6421	1.96[c]	-0.1707	-0.85	0.1500	2.08[b]
Dummy received subsidy 3 – 4 times	2.0812	1.64	-0.1092	-0.55	0.2872	3.75[a]
Dummy received subsidy 5 times	3.3267	2.06[b]	-0.0982	-0.48	0.3761	4.06[a]
Dummy received subsidy 6 times	3.7926	2.55[b]	-0.0701	-0.35	0.2189	3.17[a]
Durable assets (000 MK)	-0.0028	-4.84[a]	0.0007	10.84[a]	0.0001	3.92[a]
Logarithm of land (ha)	3.0332	4.07[a]	-0.0797	-2.20[b]	0.0393	1.30
Dummy male-headed household	-0.4732	-0.23	-0.0819	-0.96	0.1296	2.12[b]
Age of household head (years)	0.0290	1.14	0.0026	1.34	0.0008	0.51
Years of education HH head (years)	-0.0049	-0.03	0.0383	3.09[a]	0.0118	1.49
Constant	10.2863	4.92[a]	0.0619	0.34	-0.0698	-0.55
R-squared		0.0515		0.0611		0.0300
F		4.50		15.98		6.36
Prob>F		0.000		0.000		0.000
N		749		749		749
Mean of dependent variable in 2010/11	*14.271*		*0.2409*		*0.3608*	

Notes: Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Robust standard errors based on weighted regressions.

Table 10 shows mixed association between the subsidy and consumption of vegetables, with *nkwani* consumption significantly increasing among households with access to subsidy for 1-2 times, 5 times and 6 times compared to households that have never had access to subsidized fertilizers. With respect to tomato consumption, significant increases are only evident among households that have had access 5 or 6 times since 2005/06 season. Pumpkin consumption is only significantly higher among households that have had access to subsidized fertilizer throughout the period of the subsidy programme. In all these, the positive trends of consumption and frequency of subsidization suggest some positive impact of the subsidy programme.

Table 10 OLS regression estimates of subsidy and vegetable consumption in 2010/11

Dependent variable	*Amount nkhwani consumed past week (Kg)*		*Amount tomato consumed past week (Kg)*		*Amount pumpkin consumed past week (Kg)*	
	β	T	B	t	β	t
Dummy received subsidy 1 – 2 times	0.7786	2.16[b]	0.0212	0.15	0.0342	0.34
Dummy received subsidy 3 – 4 times	0.6837	1.54	0.2077	1.51	0.0497	0.50
Dummy received subsidy 5 times	1.4287	2.38[b]	0.3151	1.79[c]	0.1039	1.01
Dummy received subsidy 6 times	0.8068	1.73[c]	0.2856	2.18[b]	0.1975	1.82[c]
Durable assets (000 MK)	0.0003	0.30	0.0000	0.55	-0.0001	-3.80[a]
Logarithm of land (ha)	0.7697	5.25[a]	0.0648	1.21	0.1044	4.68[a]
Dummy male-headed household	0.5247	1.24	0.1637	2.35[b]	0.1369	3.44[a]
Age of household head (years)	0.0121	1.28	-0.0019	-0.77	-0.0026	-1.41
Years of education HH head (years)	-0.0174	-0.40	0.0214	2.62[a]	0.0068	1.23
Constant	0.1634	0.23	0.5482	2.82[a]	0.2433	1.86[c]
R-squared		0.0258		0.0405		0.0381
F		5.12		3.04		4.92
Prob>F		0.000		0.001		0.000
N		749		749		749
Mean of dependent variable in 2010/11	*1.8856*		*0.9087*		*0.3718*	

Notes: Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Robust standard errors based on weighted regressions.

There are also differences in fish and meat consumption among households with different access levels to the subsidy programme (Table 11). Fish consumption is higher among households accessing the subsidy for 5 or 6 times, with the coefficient being statistically significant at the 5 percent level. Similarly, there is significant difference in beef and chicken consumption among households accessing the subsidy for 3 to 6 times. The results generally suggest that higher frequency of receipt of the subsidy programme is associated with increased consumption of fish and meat products.

Table 11 OLS regression estimates of subsidy and fish and meat consumption in 2010/11

Dependent variable	*Amount fish consumed past week (Kg)*		*Amount beef consumed past week (Kg)*		*Amount chicken consumed past week (Kg)*	
	β	T	β	t	β	t
Dummy received subsidy 1 – 2 times	0.0185	0.86	0.0165	1.20	0.0194	1.24
Dummy received subsidy 3 – 4 times	0.0253	1.34	0.1043	2.63[a]	0.1050	2.65[a]
Dummy received subsidy 5 times	0.0582	2.37[b]	0.0877	2.18[b]	0.1189	2.32[b]
Dummy received subsidy 6 times	0.0425	2.22[b]	0.0702	3.50[a]	0.0762	3.42[a]
Durable assets (000 MK)	0.0001	8.66[a]	0.0001	0.84	0.0001	0.91
Logarithm of land (ha)	-0.0025	-0.30	-0.0005	-0.03	-0.0215	-0.83
Dummy male-headed household	0.0093	0.63	0.0249	0.89	0.0232	0.77
Age of household head (years)	0.0002	0.47	0.0014	1.82[c]	0.0018	1.62
Years of education HH head (years)	0.0067	3.05[a]	0.0061	1.69	0.0049	1.32
Constant	-0.0366	-1.19	-0.1289	-2.27[b]	-0.1373	-2.12[b]
R-squared		0.0341		0.0235		0.0217
F		21.82		2.22		2.43
Prob>F		0.000		0.019		0.009
N		749		749		749
Mean of dependent variable in 2010/11	*0.0492*		*0.0612*		*0.0702*	

Notes: Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Robust standard errors based on weighted regressions.

In summary, the estimated direct beneficiary household effects of the subsidy programme in terms of household level food security are weak. In most cases, we cannot reject the null hypothesis that the extent of subsidization does not significantly affect changes in food security using a matched panel of households. The only convincing evidence of a strong association arises from the ability of households that run out of their own produced stocks to purchase maize from the market. As noted in the analysis of economy-wide effects, maize prices have been falling and *ganyu* wages have been increasing and this has made maize affordable for most households. Food consumption between 2004/05 and 2010/11 did not change significantly for subsidy recipient households and cannot be attributed directly to the extent of subsidization. These weak and mixed results are consistent with the mixed views from the qualitative data in which households pointed out that the subsidy has enabled them to produce a 'bit more' food, particularly among poor and vulnerable households. Nonetheless, the cross-section analysis shows that households that have had access to subsidies, particularly those with access in 5 to 6 seasons, tend to consume more maize, vegetables and meat products compared to non-recipients of subsidies. Further work is needed to investigate these issues with more sophisticated model specification.

3.3.3 Subjective Poverty and Well-being

The direct impact of the subsidy programme on beneficiary well-being is assessed using households' subjective assessment of their poverty status based on a ladder ranging from 1 representing the poorest to 6 representing the richest, and households' own valuation of the level of overall satisfaction with life ranging from 1 representing very unsatisfied to 4 representing satisfied. Table 12 presents results of the subjective assessment of poverty for panel and cross-section analysis. The self-assessment of poverty for the panel households increased from 1.66 in 2004/05 to 2.34 in 2010/11, representing 41 percent increase. After controlling for household effects, the results show that households' self assessments were higher by 69 percent in 2010/11 compared to 2004/05 and the 2011 dummy is positive and statistically significant at the 1 percent level. This is consistent with hypothesised economy wide effects of the subsidy programme. However, the overall estimated impact of the subsidy is negative, although the coefficients are not statistically significant. Assets, land size and age of the household head are statistically significant and positively affect the households' evaluation of their poverty status. Using a sub-sample of panel households that was identified as poor in IHS2, we find similar results of no statistically significant relationship between self-assessed poverty and the extent of fertilizer subsidization, but the 2011 dummy although positive is not statistically significant at the 10 percent level.

The cross-section results also show that the frequency of access to subsidized fertilizers is not significantly associated with poverty self-assessment by households. However, we find that assets, size of land holdings, male headship and education of household head are positively associated with higher welfare level, with the coefficients being statistically significant at the 1 percent level. We obtained similar results based on a sub-sample of households identified as poor in IHS2.

Table 12 Regression estimates of impact on subjective poverty assessment

Dependent variable = subjective assessment of poverty status (1=poorest – 6 =richest)	Panel Households *Fixed Effects (All)*		Panel Households *Fixed Effects (Poor in IHS2)*		FISS3 Households *OLS*	
	β	t	β	T	β	t
Dummy 2011 for survey	0.6923	3.27[a]	0.5203	1.29	-0.2125	-1.09
Dummy received subsidy 1 – 2 times	-0.1616	-0.71	-0.0705	-0.15	-0.1017	-0.53
Dummy received subsidy 3 – 4 times	-0.2280	-0.97	-0.1212	-0.29	0.0285	0.13
Dummy received subsidy 5 times	0.0345	0.15	0.3279	0.72	0.0451	0.26
Dummy received subsidy 6 times	-0.0753	-0.34	-0.0148	-0.04	0.0005	0.14
Durable assets (000 MK)	0.0004	0.35	0.0273	1.91[c]	0.1385	3.12[a]
Logarithm of land (ha)	0.1140	3.20[a]	0.1039	2.05[b]	0.1733	1.85[c]
Dummy male-headed household	0.0579	0.50	0.1292	0.75	-0.0053	-2.22[b]
Age of household head (years)	0.0061	1.88[c]	0.0098	1.88[c]	0.0794	7.86[a]
Years of education HH head (years)	0.0285	1.98[b]	0.0590	2.59[a]	-0.0261	-2.33[b]
Constant	1.2071	7.31[a]	0.6612	2.13[b]	2.1494	7.99[a]
R-squared		0.3350		0.3620		0.1994
Wald Chi-squared		269.62		218.08		235.50
Prob >Chi-squared		0.000		0.000		0.000
N		896		448		747
Mean of dependent variable in 2004/05	*1.6630*		*1.4819*		*-*	
Mean of dependent variable in 2010/11	*2.3426*		*2.1526*		*2.3423*	

Notes: Superscript *a*, *b* and *c* denotes statistically significant at 1%, 5% and 10% level, respectively. Standard errors obtained through bootstrapping at 50 repetitions.

Table 13 shows regression results of the impact of the subsidy programme on overall well-being of households. Households were asked in IHS2 and FISS3 the level of satisfaction with life on a scale of 1 (very unsatisfied) to 4 (satisfied). The means of the dependent variable show that there is marginal improvement in the overall satisfaction with life from 2.3 in 2004/05 to 2.5 in 2010/11. This change is not statistically significant as represented by the dummy for the 2011 survey. The coefficient for frequency of access to fertilizers in the subsidy programme is negative, implying it causes a decrease in overall well-being, but the coefficients are statistically insignificant. Similar results are obtained for a sub-sample of households that were identified as poor in IHS2, and again most of the coefficients of the dummies for times the subsidy was accessed negative, with very low z scores. Household characteristics such as land and age of household head and male headship are positively associated with well-being assessment. The results suggest that female headed households were on average likely to have experienced a decline in overall satisfaction with life. The cross-section evidence does not support the hypothesis that subsidization leads to improvement in overall satisfaction with life. The coefficients of subsidy dummies are negative and statistically insignificant. Only assets and years of education are positive and statistically significant at the 1 percent level.

Table 13 Regression estimates of impact on subjective well-being assessment

Dependent variable = overall wellbeing assessment (1=very unsatisfied – 4 =satisfied)	Panel Households *Fixed Effects (All)*		Panel Households *Fixed Effects (Poor in IHS2)*		FISS3 Households *OLS*	
	β	z	β	z	β	z
Dummy 2011 for survey	0.4517	0.92	0.0765	0.10	-	-
Dummy received subsidy 1 – 2 times	-0.3075	-0.57	-0.0191	-0.03	-0.2726	-1.18
Dummy received subsidy 3 – 4 times	-0.4340	-0.89	0.2342	0.29	-0.1890	-0.85
Dummy received subsidy 5 times	-0.4859	-0.92	-0.1695	-0.21	-0.1621	-0.75
Dummy received subsidy 6 times	-0.4801	-0.97	-0.2558	-0.34	-0.1295	-0.60
Durable assets (000 MK)	0.0004	0.26	0.0147	1.50	0.0003	0.55
Logarithm of land (ha)	0.1477	3.38[a]	0.2378	3.28[a]	0.0424	0.88
Dummy male-headed household	-0.2832	-1.84[c]	-0.5250	-3.05[a]	0.1207	1.37
Age of household head (years)	0.0066	1.31	0.0013	0.14	0.0008	0.28
Years of education HH head (years)	0.0120	0.44	0.0468	1.51	0.0375	3.51[a]
Constant	2.2877	8.47[a]	2.4669	5.04[a]	2.3774	8.17[a]
R-squared		0.0407		0.0837		0.0367
F		22.01		33.15		24.91
Prob >F		0.015		0.000		0.003
N		885		445		746
Mean of dependent variable in 2004/05	*2.3157*		*2.2338*		-	
Mean of dependent variable in 2010/11	*2.4983*		*2.3628*		*2.5126*	

Notes: Superscript *a*, *b* and *c* denotes statistically significant at 1%, 5% and 10% level, respectively. Standard errors obtained through bootstrapping at 50 repetitions.

In summary, we cannot reject the null hypothesis that receipt of the subsidy does not statistically affect changes in self-assessment of poverty and overall subjective well-being assessment among beneficiaries. This suggests that the subsidy programme may have weak direct income effects on beneficiary households. The results are also a confirmation of the sentiments expressed in qualitative interviews in which most households are not able to produce surplus maize which could be sold to earn extra income. Life histories with selected households revealed that although some have had access to subsidized fertilizers continuously they still struggle to produce maize that takes them to the next harvest and have to rely on *ganyu* to earn income to purchase food. Small but insignificant positive effects are consistent with small improvements which are overshadowed by the effects of larger variables not accounted for in the models.

3.3.3 Schooling and Health

3.3.3.1 Primary School Enrolment

We investigate the impact of beneficiaries' access to subsidised inputs on schooling based on enrolment of primary school age group between 5 - 13 year olds while controlling for household characteristics. In both the IHS2 and FISS3, members of households more than 5 years were asked whether they were in school. This enabled us to generate an indicator of school enrolment at household level. The primary enrolment at household level is computed as the number of primary school age children in school divided by the total number of the primary school going age children in the household. Table 14 shows results on the impact of subsidy access on primary school enrolment and the panel results indicate that the subsidy has a positive impact on schooling. There has been a general increase in school enrolment between the two periods, a change that was universally confirmed by focus group discussions and key informant interviews. The coefficients of 1-2 times, 5 times and 6 times access dummies to the subsidy programme

are statistically significant at the 5 percent, 1 percent and 10 percent level, respectively. However, there is no clear trend in the value of the coefficients of times of receipt and primary school enrolment. With respect to household characteristics, we find land and male headship to be positively associated with primary school enrolment at household level. In the sub-sample of households that were identified as poor in IHS2, only the coefficients of access to subsidized fertilizers for 1-2 times and 5 times are statistically significant at the 10 percent level. The cross-section evidence is weak and the results show no significant relationship between subsidization and school enrolment among household with primary school going age members.

Table 14 Regression estimates of impact on household school enrolment

Dependent variable = primary school enrolment at household level	Panel Households *Fixed Effects*		Panel Households *Fixed Effects (Poor in IHS2)*		FISS3 Households *OLS*	
	β	Z	β	z	β	z
Dummy 2011 for survey	-0.1279	-1.06	-0.3782	-1.21	-	-
Dummy received subsidy 1 – 2 times	0.3135	2.26[b]	0.5364	1.74[c]	0.0308	0.41
Dummy received subsidy 3 – 4 times	0.1881	1.55	0.3776	1.16	0.0709	0.95
Dummy received subsidy 5 times	0.3374	2.70[a]	0.5828	1.87[c]	0.0781	1.01
Dummy received subsidy 6 times	0.1977	1.67[c]	0.3795	1.20	0.0488	0.67
Durable assets (000 MK)	0.0000	-0.10	0.0031	0.99	0.0000	0.07
Logarithm of land (ha)	0.0523	2.00[b]	0.0780	2.76[a]	0.0173	1.26
Dummy male-headed household	0.1655	2.24[b]	0.0812	0.91	-0.0546	-2.47[b]
Age of household head (years)	-0.0014	-0.65	-0.0004	-0.13	0.0013	1.87[c]
Years of education HH head (years)	-0.0153	-1.40	-0.0063	-0.42	0.0096	3.81[a]
Constant	0.8174	6.66[a]	0.7802	4.35[a]	0.7721	10.2[a]
R-squared		0.1158		0.1191		0.0438
Wald chi-squared		31.15		19.49		34.43
Prob > chi-squared		0.001		0.035		0.000
N		653		371		550
Mean of dependent variable: 2004/05	*0.8148*		*0.8903*		-	
Mean of dependent variable: 2010/11	*0.8956*		*0.8100*		*0.8936*	

Notes: Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Standard errors obtained through bootstrapping at 50 repetitions.

3.3.3.2 Incidence of under-5 illness

Improvements in food availability at household level due to access to subsidized fertilizers may help reduce the incidence of illness among under-five year olds. In order to investigate the impact of subsidy receipt on incidence of illness we use data for households that had under-5 members in 2004/05 and 2010/11. On average, about 59 percent of households had ill under-5 members in 2004/05, but this fell to 49 percent in 2010/11. This impact was not commonly articulated in focus group discussions and key informant interviews. The econometric evidence of the impact of the subsidy programme on the health of children in beneficiary households shows that households that had access to subsidy at least 5 times were more likely to have under-5 that had not fallen ill in the past two weeks of the survey (table 15). Overall, there is a negative relationship between access to subsidy and incidence of under-5 illness. In the panel regression analysis, the coefficients of dummies for households that have had access to subsidized fertilizers for 5 times and 6 times are statistically significant at the 5 percent level. In the cross-section analysis, only in female headed households and younger headed households do we find less incidence of under-5 illness. However, there is no clear trend in the value of coefficients of dummies representing frequency of access to support the

negative relationship between incidence of under-5 illness and the number of times the household has had access to subsidized fertilizers.

Table 15 Regression estimates of impact on incidence of under-5 illness

Dependent variable = 1 if household had an ill under-5 member	Panel Households *Fixed Effects*		FISS3 Households *OLS*	
	β	t	β	T
Dummy for 2011 survey	0.0165	0.16	-	-
Dummy received subsidy 1 – 2 times	-0.0913	-0.56	-0.0607	-0.31
Dummy received subsidy 3 – 4 times	0.1618	1.33	0.0198	0.11
Dummy received subsidy 5 times	-0.3634	-2.05[b]	-0.0623	-0.29
Dummy received subsidy 6 times	-0.2398	-2.11[b]	-0.1485	-0.77
Durable assets (000 MK)	-0.0002	-0.53	-0.0001	-0.17
Logarithm of land (ha)	0.0498	0.81	-0.0039	-0.16
Dummy male-headed household	-0.1766	-1.25	-0.1221	-1.70[c]
Age of household head (years)	-0.0016	-0.28	-0.0063	-3.50[a]
Years of education HH head (years)	0.0062	0.25	0.0045	0.66
Constant	0.7752	3.30[a]	0.9088	4.05[a]
R-squared		0.1223		0.0572
F		35.24		47.52
Prob >F		0.000		0.000
N		446		376
Mean of dependent variable: 2004/05	*0.5928*		-	
Mean of dependent variable: 2010/11	*0.4895*		*0.5053*	

Notes: Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Standard errors obtained through bootstrapping at 50 repetitions.

In summary, we find evidence of a positive impact of involvement in the subsidy programme on schooling and health. Primary school enrolment has increased and under-5 illness has generally declined between 2004/05 and 2010/11, consistent with an economy wide effect (although the difference is not statistically significant), and we can reject the null hypothesis that subsidy receipt in the programme does not have any significant impact on schooling and health among beneficiary households. Most focus group discussions and some life histories reported increase in school attendance and there is some anecdotal evidence of reduction in malnutrition. However, these could also be possible due to other programmes such as school feeding and under-5 feeding programmes that we have not controlled for in this analysis.

3.3.4 Shocks and Stresses

The numbers of shocks captured in the IHS2 and FISS3 questionnaires were similar and table 16 shows that on average the number of shocks decreased from 4.8 per household in 2004/05 to 3.4 per household in 2010/11. Using the difference-in-difference regression model, this does not represent a significant decline in the number of shocks between 2004/05 and 2010/11. With respect to the relationships between shocks and the frequency of subsidization, on average, the results show that recipients of fertilizer subsidies tend to experience less shocks than non-recipients. We find statistically significant relationship between experience of shocks and those households that have had access to the subsidy for 3-4 times to 6 times. However, there is no clear trend in the value of subsidy access coefficients to suggest that the more household access subsidies the lower the number of times they experience shocks. Considering only a sub-sample of panel households identified as poor in IHS2, the results show a significant decline in the number of shocks overall, but the poor that have been receiving subsidized fertilizer continue to experience an increase in the number of shocks. We find all the coefficients

of dummies representing the frequency of receipts of subsidized fertilizers to be statistically significant at the 5 percent or 1 per cent levels. Among poor households, the number of shocks significantly falls with the age of the household head and the number of years of education of the household head.

The cross-section analysis of all households in the FISS3 shows that frequencies of receipt of subsidized fertilizers are positively related to number of shocks and the coefficients are statistically significant. The results further show that households with larger land parcels and household headed by older persons experience less shocks. The coefficients of land and age of household head are statistically significant at the 1 percent level. There is no clear trend in the value of subsidy access coefficients to suggest that the higher the number of times households receive fertilizer subsidies the lesser the number of shock they experience.

Table 16 Regression estimates of impact on shocks and stresses

Dependent variable = number of shocks experienced by household	Panel Households *Fixed Effects (Full)*		Panel Households *Fixed Effects (Poor in IHS2)*		FISS3 Households *OLS*	
	β	z	β	z	β	z
Dummy for 2011 survey	0.0190	0.23	-3.0571	-3.79[a]	-	-
Dummy received subsidy 1 – 2 times	-0.2075	-1.27	1.9673	2.04[b]	1.2095	2.26[b]
Dummy received subsidy 3 – 4 times	-0.3820	-2.88[a]	3.3406	3.34[a]	0.9554	2.22[b]
Dummy received subsidy 5 times	-0.4072	-3.39[a]	2.2717	2.07[b]	0.7342	1.75[c]
Dummy received subsidy 6 times	-0.1745	-1.76[c]	2.1000	2.23[b]	1.0249	2.52[a]
Durable assets (000 MK)	0.0032	0.36	0.0038	0.09	0.0014	1.21
Logarithm of land (ha)	0.0068	0.18	0.0656	0.30	-0.7722	-6.05[a]
Dummy male-headed household	0.1746	1.62	0.1212	0.24	0.0331	0.15
Age of household head (years)	-0.0021	-0.56	-0.0655	-3.06[a]	-0.0153	-2.60[a]
Years of education HH head (years)	-0.0124	-0.77	-0.1834	-2.27[b]	-0.0493	-1.38
Constant	0.5963	3.50[a]	8.4049	6.62[a]	3.5878	5.99[a]
R-squared		0.1564		0.1509		0.0709
F		49.56		79.3		59.55
Prob >F		0.000		0.000		0.000
N		897		448		749
Mean of dependent variable: 2004/05	*4.7921*		*4.9484*		*-*	
Mean of dependent variable: 2010/11	*3.4474*		*3.4473*		*3.4423*	

Notes: Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Standard errors obtained through bootstrapping at 50 repetitions.

Table 17 reports results of the relationships between frequency of access to subsidized fertilizers and the incidence of agricultural related shocks where reported as the most severe shock. The analysis shows mixed results. The full panel results based on all panel households show that the subsidy does not significantly affect the incidence of agricultural shocks, although generally the incidence of agricultural related shocks has declined over time. However, the sub-sample of panel households identified as poor in IHS2, show that households with access to subsidized fertilizers are less likely to have agricultural related shocks as their most severe shock. The coefficients of the subsidy access dummies are statistically significant at 1 percent except for households that have received subsidized fertilizers only 1-2 times in the past six seasons. Nonetheless, there is no clear trend to suggest that the higher the number of times household access subsidies the lower the number of agricultural related shocks households experience. The cross-section analysis is similar to the full panel results, in which the extent of subsidization is

not statistically associated with the incidence of agricultural related shocks as the most severe shock experienced by households.

Table 17 Regression estimates of impact on agricultural-related shocks and stresses

Dependent variable = 1 if most severe shock experienced was agricultural related	Panel Households *Fixed Effects (Full)*		Panel Households *Fixed Effects (Poor in IHS2)*		FISS3 Households *Probit*	
	β	z	β	Z	β	z
Dummy for 2011 survey	-0.3523	-2.16[b]	0.0298	0.59	-	-
Dummy received subsidy 1 – 2 times	0.0763	0.43	-0.1439	-1.03	0.0308	0.33
Dummy received subsidy 3 – 4 times	0.0950	0.51	-0.3657	-3.03[a]	0.0616	0.74
Dummy received subsidy 5 times	0.1239	0.65	-0.3774	-3.17[a]	0.0728	0.79
Dummy received subsidy 6 times	0.1719	1.02	-0.2232	-2.64[a]	0.0649	0.75
Durable assets (000 MK)	-0.0001	-0.10	0.0004	0.04	0.0000	-0.07
Logarithm of land (ha)	0.0053	0.23	0.0126	0.34	0.0050	0.35
Dummy male-headed household	0.1993	2.72[a]	0.1550	1.35	0.0850	2.55[a]
Age of household head (years)	0.0007	0.30	-0.0031	-0.73	0.0003	0.33
Years of education HH head (years)	0.0091	0.88	-0.0147	-0.76	-0.0115	-2.75[a]
Constant	0.2966	2.67[a]	0.6742	3.03[a]	0.2144	2.23[b]
R-squared		0.1277		0.1484		0.0126
F		87.64		3.44		15.29
Prob >F		0.000		0.000		0.083
N		897		448		749
Mean of dependent variable: 2004/05	*0.5197*		*0.5809*		-	
Mean of dependent variable: 2010/11	*0.2770*		*0.3286*		*0.2815*	

Notes: Superscript a, b and c denotes statistically significant at 1%, 5% and 10% level, respectively. Standard errors obtained through bootstrapping at 50 repetitions.

In summary, the evidence on changes in shocks and stresses is rather mixed. Overall, the number of shocks experienced by beneficiary households has fallen significantly although among poor households there has been significant increase among beneficiary households. However, among beneficiary households, agricultural-related shocks are less likely to be the most severe shocks, hence the subsidy has helped poor households to be cushioned or resilient against agricultural-related shocks. These positive effects are consistent with the economy-wide effects of reduction in the prices of food, better *ganyu* opportunities and wages accompanied by good weather conditions as table 18 shows for panel households.

Table 18 Most severe shocks and stresses experienced by households (%)

Most severe shock experienced	2004/05	2010/11
Lower crop yields due to weather/rainfall	24.45	13.34
Crop diseases or crop pests	0.78	1.35
Livestock died or were stolen	3.01	6.09
Household business failure non-agricultural	3.41	1.61
Loss of salaried employment or non-payment	1.85	0.74
End of regular assistance, aid or remit	1.01	0.7
Reduced *ganyu* opportunities/wage rates	5.60	1.05
Large fall in sale prices for crops	19.30	7.07
Large rise in price of food	9.05	3.33
Short acute illness/accident of HH member	1.15	17.84
Chronic illness, disability or ageing of HH member	2.45	8.84
Birth in the household	4.23	0.75
Death of HH member	14.54	10.48
Marriage/other social event	1.60	2.95
Increased expenditure demands	2.82	2.79
Break-up of the household	1.60	1.92

Source: Computed by authors based on IHS2 and FISS3 data

4.0 Impacts from Life Stories of Beneficiary Households

The analysis of life stories from selected beneficiaries reveals a mix of the impact of the subsidy on their well-being. While there are positive stories about the increase in food production at household level among most households that receive subsidies, the life histories illustrate the challenges of the programme in delivering direct benefits to beneficiary households. In most life histories of beneficiaries, particularly among the most vulnerable groups (female-headed, elderly-headed and child-headed households), the stories were that the subsidy programme has enabled them to produce 'a bit more food' than when they had no access to the subsidy. Box 1 and 2 provide selected sentiments from some of the beneficiaries on the impact of the farm input subsidy programme since the 2005/06 season. The qualitative analysis points to the following issues:

- In most cases, households that report success with the subsidy programme are those that are well to do and were already purchasing commercial fertilizers before the subsidy programme. For instance, one of the beneficiaries from Kasungu who has had access to the subsidy over 5 seasons, was also buying coupons that enabled him to profit from tobacco cultivation, and claimed to have transformed his life from poor category to the well-to-do category.

- In households that reported receipt and use of 2 fertilizer coupons, such households are likely to talk positively about the extent to which the subsidy improved their food production for such years compared to households that received less than 2 bags of subsidized fertilizers.

Box 1 Selected positive life stories from the subsidy programme

"The programme has enabled me to apply fertilizer. At first I was doing business but I was not able to buy fertilizer and could end up buying maize every year. Nowadays subsidized inputs are cheap and I am able to buy fertilizer after doing *ganyu* or selling firewood. I harvest enough food for my family although I do not get much to sell but I feel comfortable that I have enough food." *[Female headed beneficiary with access to coupons in 3 seasons, Blantyre]*.

"I have enough food and peace inside of me because I am assured that my grandchildren have something to eat. Other than that, there is no other manifestation of the impact of the subsidy." *[Widow beneficiary with access to subsidy since 2005/06 (6 seasons), Blantyre].*

"I used to grow tobacco and buy commercial fertilizer before the subsidy programme. The major impact of the subsidy programme is that we are able to harvest enough food that run to next harvest and also sell some of it because we have surplus. Nowadays, we no longer go for *ganyu* work in other people's farms to get good" *[Married (69 year old) male head with access to subsidy in 6 seasons, Kasungu].*

"There has been some change since the amount of food I have been harvesting for the past five years, this is due to access of fertilizer although the amount is very little for one to see. Without the subsidy I could only manage to harvest 2 ox-carts from a 1 acre field of maize (that is before 2005/6) but now at least I can get 3 ox-carts of maize" *[Married (32 years old) male head with access to subsidy in 1 season, Lilongwe]*.

"I used to buy commercial fertilizer before subsidy and the year I did not receive coupons I bought commercial fertilizer. With respect to the impact of the subsidy programme, it has helped me in bringing food on my table. Without subsidy I think I would have been a tenant somewhere by now. Just imagine by the end of sales of 2006/07 I bought another bicycle, dining set and a radio out of the money earned through the subsidized fertiliser" *[Married (31 year old) male head receiving 2 coupons in 4 seasons, tobacco farmer, Mzimba]*.

"Prior to the subsidy we used to buy fertilizer on credit, but we have been benefiting from the subsidy since it started in 2005/06. The major impact of the subsidy programme in all the years that my household has been benefiting is that we harvest enough food which runs up to next harvesting period. We also sell the surplus and earn money that we use to buy commercial fertiliser although its one or two bags only" *[Married (78 year old) male head with access to subsidy in 6 seasons, Mzimba].*

"The subsidy programme has really changed my life because I never go to bed hungry since prices of food have gone down. I am at least living a healthy life since *ganyu* prices have increased and I am able to earn K400 a day when I do *ganyu*" *[Married (38 year old) female with access to subsidy in 3 seasons, Thyolo].*

- Sharing of coupons is widespread, and most households that have participated in the subsidy programme attribute the perceived failure of the programme to change their lives significantly due to the inadequate amounts of fertilizers. This is particularly the case for households that have never used fertilizers prior to the subsidy programme. There are many life stories that described how the full package of the subsidy was beginning to change their lives, only to experience drifting back to poverty due to the dilution of the subsidy as a result of the redistribution that takes place at village level.

- There is also a tendency for beneficiaries to thinly spread the subsidized inputs over a larger parcel of land. Even among households that receive 2 bags of subsidized fertilizers, the sentiments that the subsidized fertilizer was not adequate for the amount of land the household has for maize cultivation. This is exacerbated by the lack of technical advice on the appropriate use of fertilizers, with most households expressing lack of access to agricultural extension services.

- There is widespread recognition that the subsidy has helped beneficiary households to produce a 'bit more maize' and more importantly in reducing the purchase price of maize even in lean months of January and February. Most of the beneficiaries interviewed, particularly those that are still not able to produce own maize to last them to the next season, consider a low price of maize as one major benefit of the programme.

Box 2 Selected limited impact life stories from the subsidy programme

"The 2007/08 season was a set back again owing to sharing of coupons compared to the receipt of one coupon per household. We no longer had to receive one coupons for each household alone and that was slowly walking us back down to the path we had been rescued from life of food in sufficiency – painful life" *[Female head and widow with access to coupons in 6 seasons, Lilongwe]*.

"I have not seen real change in my life since 2005/06 season. I am as poor as I was in 2004/05 season. Subsidy fertilizer is not adequate as I have been getting 1 bag or sharing 1 bag with another household and in 2010/11 season I shared 1 bag with another villager. I am still failing to produce enough for my own consumption. If I had access to 2 bags each year I could have improved my life" *[Female head and divorced with access to coupons in 5 seasons, Kasungu]*.

"Since 2005/06 and 2009/10, I experienced so many changes in my welfare because of the introduction of the subsidy program. In 2005/06 I received two fertilizer coupons and 2kg of hybrid seeds. During that season, I harvested ten 50kg bags of maize and had enough food throughout the year. However, in 2007/08 I received one fertilizer coupon (25kg of 23-21-0 and 25kg of Urea) and harvested only two 50kg bags of maize. As a result, the food ran out after three months only." *[Married female beneficiary with access to subsidy in 4 seasons, Blantyre]*

"The harvest has never been enough since 2006/07 season. The maize we have been harvesting has never gone past the month of January. We depend on *ganyu* to survive. I have not really seen the real impact of subsidy on our household. The 1 bag of fertiliser we are benefiting from this programme we could afford to buy even before subsidy. Even if this programme is to end I think we can still afford to buy a single bag of fertiliser, only what my husband has to do is to stop drinking beer" *[Married (35 year old) female with access to subsidy in 6 seasons, Mzimba]*.

"The inputs subsidy programme has not yet had a positive impact on my life due to old age. In 2009/10 season I only managed to harvest 5 bags of maize weighing 50 kg from the 2 bags of subsidized fertilizers that I got" *[Married (81 year old) male head with access to subsidy in 2 seasons, Thyolo].*

"Things did not just turn around immediately but the period we usually spend on *ganyu* is gradually being reduced. We are now able to keep maize nearly throughout the season without much *ganyu* on other people's farms. Noting much of a change except slightly higher maize stock levels and a little saving which also ends up in buying the subsidized inputs" *[Married female with access to subsidy in 6 seasons, Ntcheu].*

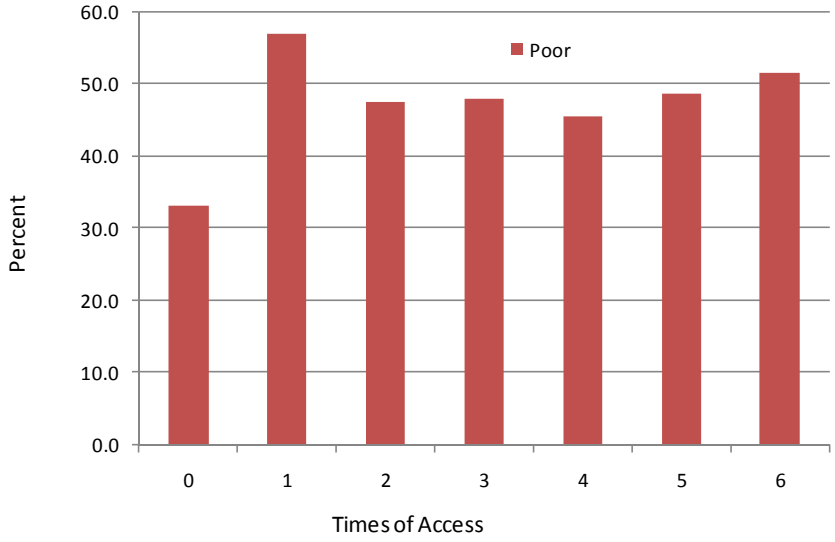
"Now I harvest 2 – 3 bags of maize and this maize is not enough for my family. However, the subsidy has still helped my food security" *[Widow (60 years old) female head with access to subsidy in 2 seasons, Phalombe]*.

- Households that are not able to produce maize that last up to the next harvest tend to purchase from the market. Most poor households engage in *ganyu* to earn incomes to buy maize and most reported that *ganyu* wage rates have been increasing while maize prices have been falling and maize is locally available. This has enabled the poor to afford purchase of maize based on *ganyu* incomes which have also improved over time. Due to higher wages, households reported that they have reduced the amount of time they spend on *ganyu* and there has also been an increase in opportunities to operate off-farm income generating activities.

- Poor and vulnerable households such as female and/or elderly headed households that received subsidy fertilizers rarely supplement the supply of fertilizers with commercial purchases, leading to application of subsidized fertilizers on larger parcels of land. Generally, where subsidized fertilizers are supplemented by commercial fertilizers, such households were buying commercial fertilizers prior to the subsidy or they are better off households that are also receiving subsidies. The quantitative analysis also shows that the supplementary commercial fertilizers are much less for poor households than for non-poor households that had access to subsidized fertilizers.

The analysis of the case studies of beneficiaries also highlighted two challenges that have implications on direct beneficiary impacts of the subsidy programme: targeting and sharing of coupons at village level. These issued have been documented in Dorward and Chirwa (2011), but we use panel data to illustrate the challenges of beneficiary targeting. With respect to targeting, the targeting criteria in the FISP remain quite broad with the main criteria as 'resource poor households', and this has meant that a large proportion of households is eligible from the perspective of communities (SOAS et al, 2008). Although the FUM (2011) study suggests that all the households fitted into the criteria by the reason they gave for their being selected for the subsidy programme, a majority (60 percent) indicated their being 'very poor' justified their receipt of coupons – but no information is provided on the status of households who did not receive the subsidy. When we use the IHS2 poverty status of beneficiaries, as their initial condition, and data from IHS2 and FISS3 surveys, we find that the poor and non-poor are equally likely to receive subsidized farm inputs. The broadness of the targeting criteria therefore leads to high targeting errors. Figure 5 presents the proportion of the households that were identified as poor in the IHS2 based on per capita expenditure and their relative access to subsidized fertilizers in the past 6 agricultural seasons. The figure shows only a third of those that have never received subsidized fertilizers were poor households in 2004/05. This would be broadly in line with the poor being more likely to receive subsidy coupons. However, among recipients of subsidized fertilizers, the highest proportion of the poor is in the category that only received the subsidy once in the past 6 seasons while for those that have continuously received fertilizer subsidy only about 51 percent were identified as poor in 2004/05. The panel data on who received subsidized fertilizers generally show that on average only half of the recipients were poor households on the basis of IHS2 poverty classification.

Figure 5 Access to subsidized fertilizers by IHS2 poor households 2005 - 2010



As observed above, non-poor households bought more commercial fertilizers on average than poor households although they received equal amount of subsidized fertilizers. This suggests that non-poor households could generally afford commercial fertilizers and receipt of coupons among them largely represented targeting inclusion errors. This is also confirmed by the fact that there was no clear pattern on the perceptions of respondent households on which group was more likely than others to receive coupons, between better off farmers and poor and vulnerable households (Dorward and Chirwa, 2011).

With respect to redistribution of subsidy coupons within the villages, this practice has been widely reported by beneficiaries and from previous evaluations which indicate that a sizable proportion of households receive less than 2 coupons per household. Dorward and Chirwa (2011) find that 58 percent of households that received coupons in 2010/11 received less than 2 coupons; an increase from 49 percent in 2008/09 (Dorward et al, 2010). Table 19 shows the coupon allocation processes by the district, and it is evident that although the open system is widely used for allocation and distribution of coupons, redistribution is widespread within the village. On average, just under 80 percent of households indicated that open meetings were used in the allocation of coupons, with the highest proportion (97 percent) in Phalombe and the lowest (54 percent in Lilongwe). Similarly, use of open meetings in the distribution of coupons was also popular in the 2010/11 season, with 94 percent indicating the use of open forums. Lilongwe had the lowest proportion of 81 percent while Mzimba and Ntcheu had universal use of open forums in coupon distribution. The use of redistribution of coupons, which is unofficially organized by traditional leaders, is widespread. On average, just under 70 percent of respondents reported redistribution of coupons where sharing is organized in the 2010/11 season, compared to 43 percent in the 2008/09 season. Kasungu and Mzimba had a low incidence of redistribution, with only about a third of respondents reporting that such practices occurred in their village while for the rest of the districts was redistribution by more than two-thirds of respondents.

Table 19 Systems of fertilizer coupon allocation and distribution in 2010/11 season

District	Open system of coupon allocation	Open system of coupon distribution	Redistribution of coupons within village
Mzimba	0.7923	1.0000	0.3356
Kasungu	0.7017	0.9206	0.3116
Lilongwe	0.5365	0.8096	0.6720
Ntcheu	0.8453	1.0000	0.9310
Zomba	0.9267	0.9944	0.8780
Blantyre	0.8823	0.9909	0.7658
Thyolo	0.9230	0.9885	0.9497
Phalombe	0.9722	0.9617	0.9633
Total	**0.7866**	**0.9405**	**0.6929**

Source: Computed by authors based on FISS3 data

Widespread redistribution of fertilizer coupons was also confirmed from focus group discussions and life histories of beneficiaries. In focus group discussions, there was a mix of views on the extent of openness in the targeting processes with politics playing a major role in some cases. Some of the groups also reported widespread use of sharing of coupons after the formal allocation process. Life histories of some of the beneficiaries also reported the problem that sharing of coupons diluted the direct benefit per household. The practice of redistribution of subsidized input undermines the direct impact of the programme on beneficiary households and is likely to reduce the effectiveness of the direct impacts of subsidy programme and undermine the potential for some households to graduate from the programme.

5.0 Conclusions

The farm input subsidy programme which has been implemented since 2005/06 season has benefited households in different ways. The 2010/11 season marked its sixth year of implementation and some households have had continuous access while others have had intermittent access to subsidized fertilizers. This paper set out to evaluate the impact of the subsidy programme on the economy, input market systems and welfare of beneficiary households using the panel data estimation of difference-in-difference estimator. Overall, although qualitatively communities point to the many benefits of the subsidy programme on food security, yields and other indicators of well-being, the econometric evidence that changes in welfare indicators are attributed to the direct effects of subsidy receipt is weak and mixed. The effectiveness of the subsidy programme on delivering direct benefits to beneficiary households appears to be undermined by ineffective targeting, inefficiency in the application of the subsidized fertilizers and the increased dilution of the benefit package per household through the process of redistribution that takes place at village level. Nonetheless, households tend to benefit from the economy-wide impact of the subsidy programme through low maize prices and increased *ganyu* wage rates that have been experienced since the introduction of the subsidy programme. The following are the main findings:

- The macroeconomic environment has remained stable over the period of implementation of the subsidy programme. Growth in agricultural output and gross domestic product has been positive though falling more recently and inflation has been falling to single digit levels. Such stability has made most basic commodities affordable for most rural households. Nonetheless, public debt has

been increasing since 2005/06 and this imposes future burdens of debt servicing.

- The subsidy programme seems to have stronger economy-wide effects than direct beneficiary household effects. Over the past 6 agricultural seasons of implementation of the subsidy programme, the prices of maize have fallen, contributed to macroeconomic stability through falling inflation from double digit to single digit figures. The decrease in the maize prices, together with reported increases in *ganyu* wage rates, has meant that the poor and non-poor can afford to purchase of maize at reasonable prices. In fact, there has a been real increase in *ganyu* wage rates measured in terms of the amount of maize a daily wage could purchase between 2010 and 2011.

- The farm input subsidy programme continues to have a negative impact on demand for commercial fertilizers. Although, recipients and non-recipients of subsidized fertilizers purchase commercial fertilizers, there is statistical evidence of the overall displacement effects of the subsidy programme on commercial sales that suggests that a 1 percent increase in subsidized fertilizers induces 0.15 – 0.21 percent reduction in commercial fertilizer demand. Targeting of the subsidy programme remains broad and prone to exclusion and inclusion errors, and combined with the increase in the sharing of coupons tends to contribute to these displacement effects.

- There is no statistically significant direct impact of receipt of subsidised inputs on most of the beneficiary household welfare indicators using the difference-in-difference indicators, although most of the relationships are positive as expected. These indicators that have weak relationship with access to subsidized fertilizers include self-assessment of adequacy in food consumption, food consumption score, coping strategy index, self-assessment of poverty and well-being. These weak direct beneficiary impacts have also been found in earlier studies. For instance, Chirwa (2010) in an earlier impact evaluation study also finds weak evidence of the direct impact of participation in the subsidy programme on beneficiary households' food expenditure between 2004/05 and 2006/07. Similarly, Matita and Chirwa (2011), using panel data analysis, find mixed results on the direct impact of participation in the subsidy programme in improving agricultural growth of beneficiary households between 2004/05 and 2008/09 seasons among households in different income quintiles. The direct beneficiary effects are somehow masked by the stronger economy-wide effects, in which the subsidy benefits both recipients and non-recipients thereby weakening differences between the two groups. However, there are positive trends in food security outcomes between the number of times households access the subsidy in 6 of 7 food security indicators used in the analysis.

- Although there is no statistically significant impact on self-assessed food consumption adequacy and access to the subsidy, there is evidence that among households that run out of their own maize stocks before the next harvest the amount of maize purchased was lower for households that have benefited more from the subsidy over the past 6 seasons than those that benefited once in the past 6 seasons. In addition, there are significant relationships in the cross-section analysis between access to subsidies and consumption of foods such as maize, bananas, vegetables, fruits and meat products. This purchasing power is

consistent with economy-wide effects of the subsidy programme on maize prices and increase in *ganyu* wage rates which are the main source of income for purchasing maize by poor households.

- Another positive result is the impact of the subsidy programme on primary enrolment and incidence of under-5 illness at household level. This is supported from both the quantitative and qualitative analysis. Access to subsidized fertilizers positively increases the primary enrolment ratio, significantly among households who have had access to the subsidy for 1-2, 5 and 6 agricultural seasons. With respect to health, we find evidence of reduction in incidence of under-5 illness among households that have benefited from the subsidy 5 and 6 times over the past 6 agricultural seasons. However, in both of these indicators there is no clear trend in the relationship between the indicators and the frequency of access to subsidized fertilizers in the past 6 seasons.

- Households with access to subsidized fertilizers are also likely to experience a smaller number of shocks and stresses, particularly those that have had access to the subsidy for more than 2 seasons. When we only consider households identified as poor in 2004/05, we find that subsidized households tend to experience higher number of shocks than those without access. However, poor and subsidized households are unlikely to experience agricultural-related shocks and stresses as their most severe shock. In addition, we find no clear trend in the mean impact on shocks and stresses as the frequency of times of receipt of the subsidy increases.

The impact analysis raises two challenges with implications on the direct beneficiary household impacts of the subsidy programme. First, targeting of households remains problematic and a large proportion of non-poor households have access to subsidized farm inputs. This increases displacement of commercial sales and limit incremental production. Secondly, the practice of redistribution of coupons at village level, which is largely driven by village level politics, has led to the dilution of the benefit package resulting in inefficient use of subsidized fertilizers among poor households that are not able to top up with commercial fertilizers, but cultivate larger parcels of land. These challenges of targeting, dilution of the benefit package and inefficiency in the application of inputs may also undermine prospects of graduation from the subsidy programme for most of the households.

References

Chirwa, T. G. (2010) Program Evaluation of Agricultural Input Subsidies in Malawi using Treatment Effects: Methods and Practicability based on Propensity Scores, *MPRA Paper No. 20878*. Available at http://mpra.ub.uni-muenchen.de/20878.

Dorward, A. and Chirwa, E. (2010a) Evaluation of the 2008/09 Agricultural Input Subsidy Programme, Malawi: Notes on Regression Analysis of Maize Production. Paper prepared for Malawi Government and DFID (Malawi).

Dorward, A. and Chirwa, E. (2010b) Evaluation of the 2008/09 Agricultural Input Subsidy Programme, Malawi: Report on Programme Implementation. Paper prepared for Malawi Government and DFID (Malawi).

Dorward, A. and Chirwa, E. (2011) Evaluation of the 2010/11 Farm Input Subsidy Programme, Malawi: Report on Programme Implementation. Paper prepared for Malawi Government and DFID (Malawi).

Dorward, A., Chirwa, E. and Slater, R. (2010) Evaluation of the 2008/09 Agricultural Input Subsidy Programme, Malawi: Report on Programme Implementation. Paper prepared for Malawi Government and DFID (Malawi).

Farmers Union of Malawi (FUM) (2011) Promoting the Participation of Civil Society in the Management of the Farm Input Subsidy Programme (FISP), Lilongwe: Farmers Union of Malawi.

Imperial College of London (ICL), Wadonda Consult, Michigan State University and Overseas Development Institute (2007) Evaluation of the 2006/7 Agricultural Input Supply Program, Malawi. Interim Report prepared for Malawi Government and DFID (Malawi).

Matita, M. M. and Chirwa, E. W. (2011) Agricultural Growth and Poverty in Rural Malawi, Research Report submitted to the African Economic Research Consortium, Nairobi.

Maxwell, D. and Caldwell, R. (2008) The Coping Strategies Index: Field Methods Manual, CARE.

Ricker-Gilbert, Jacob., Jayne, Thom. J. and Chirwa, Ephraim. W. (2010) Subsidies and Crowding Out: A Double-Hurdle Model of Fertilizer Demand in Malawi, **American Journal of Agricultural Economics, 93 (1)**, 26 – 42.

School of Oriental and African Studies (SOAS), Wadonda Consult, Michigan State University and Overseas Development Institute (2008) Evaluation of the 2006/7 Agricultural Input Supply Program, Malawi. Final Report prepared for Malawi Government and DFID (Malawi).

Woodridge, J. M. (2000) **Introductory Econometrics: A Modern Approach**, Cincinnati: South-Western.

WFP (World Food Programme) (2008) Food Consumption Analysis: Calculating and Use of the Food Consumption Score in Food Security Analysis, Rome: WFP Vulnerability Analysis and Mapping Branch.