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Who is Vouching for the Input Voucher? Decentralized Targeting and Elite Capture in Tanzania

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Summary. — Through decentralized targeting of input vouchers new agricultural input subsidy programs aim to more effectively reach their objectives and target population. But, lingering fears of elite capture remain. These are borne out in the 2009 input voucher program in Kilimanjaro, Tanzania. Sixty percent of the voucher beneficiaries were households with village officials. This significantly reduced the targeting performance of the program, especially in unequal and remote communities. When targeting the poor, greater coverage and concentration in higher trust settings mitigated these concerns. Scrutiny remains important when relying on decentralized targeting, as is a clearer sense of purpose of input vouchers.

Key words — local elite, decentralization, targeting, fertilizer, voucher program, Tanzania

1. THE CHALLENGE OF TARGETING

Over the past couple of years, many governments in Sub-Saharan Africa have re-embraced large scale agricultural input subsidy programs to raise their agricultural output and reduce poverty among their smallholders (Kelly, Crawford, & Ricker-Gilbert, 2011). It is argued that many of the past shortcomings of nationwide input subsidy programs such as the limited increase in smallholder productivity, unsustainably high fiscal burdens, and political entrenchment can be overcome if the programs are "market smart" (Dorward, 2009; Morris, Kelly, Kopicki, & Byerlee, 2007).

Subsidy programs are "market smart" if they are part of a broader productivity enhancement program, if they have a clear exit strategy, and most importantly, if they are carefully targeted at helping agents overcome market failures. [1] Especially credit and insurance markets are often absent or incomplete, preventing cash-strapped farmers to access inputs, but input markets may also need an initial (demand) push to help input providers overcome high initial distribution costs and achieve economies of scale.

Whether the new generation of input subsidy programs is indeed more robust against the shortcomings of the past is ultimately an empirical question. This paper explores this question within the context of a large smallholder input subsidy program introduced in 2009 in Tanzania and focused on the innovations used in the distribution of the subsidies. It is first examined whom the subsidies have been going to in practice, which is subsequently compared with whom they should have been going to, to assess targeting performance.

There are many ways to target transfers (Coady, Grosh, & Hoddinott, 2004). But, it is the decentralized distribution of input vouchers that has become the vehicle of choice to target input subsidies. Vouchers entitle farmers to buy modern inputs (usually inorganic fertilizer and improved seeds) from participating input retailers at a subsidized price. Distribution of the vouchers to the beneficiary farming households is delegated to different levels of government, whereby geographic targeting—the selection of districts and villages within districts based on their agro-ecological potential—is often combined with community based targeting—the selection of beneficiaries within the village by the community.

Decentralized targeting has been frequently applied in anti-poverty interventions and safety net programs (Grosh, del Ninno, Tesliuc, & Ouerghi, 2008). It seeks to exploit the privileged knowledge local governments and communities have about the conditions of the beneficiaries to reduce the administrative cost of targeting. As local leaders are likely to be held more accountable by their local constituencies, who have difficulties monitoring a distant central government, it is assumed that local leadership is more likely to follow targeting guidelines and act in the interest of the beneficiaries.

Nonetheless, the empirical evidence has so far been mixed and elite capture of the benefits of decentralized poverty programs remains a real concern (Mansuri & Rao, 2004). Alderman (2002) and Faguet (2004) report that the decentralization of development programs improved targeting toward the poor in Albania and Bolivia respectively, while in Bangladesh's decentralized Food-for-Education Program, within village allocation of funds appeared more pro-poor than allocation across villages (Galasso & Ravallion, 2005). Park and Wang

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(2010), on the other hand, find that China's community based development program—its flagship poverty alleviation program—only increased the incomes of the better off in each village and not those of the poor, and Platteau (2004) shows that the local elite took control of social fund expenditures in West Africa.

Several factors have been advanced to explain the likelihood of elite capture in different contexts, including political factors such as the local power structure (Bardhan & Mookherjee, 2006) and levels of awareness (Bardhan & Mookherjee, 2000), economic factors such as income level and poverty (Galasso & Ravallion, 2005), sociological factors such as community homogeneity (Seabright, 1996) as well as program design features such as the size of the program (Galasso & Ravallion, 2005), the official eligibility criteria and whether the program concerns the distribution of public or private goods (Araujo, Ferreira, Lanjouw, & Ozler, 2008). Nonetheless, no clear-cut insights have emerged so far about the conditions under which decentralized targeting is likely to be more successful.

Whether elite capture also poses a challenge in the decentralized targeting of input vouchers, and if so, under which conditions, are important empirical questions in assessing the performance of the new generation of input subsidies. Ghana's 2008 experience already counsels caution, with more vouchers of its new, market-smart input voucher program targeted to districts that the ruling party had lost in the previous presidential elections, indicating some political capture of the program (Banful, 2011). In this study, the focus will be more on the performance of community based targeting, i.e. after the district allocations have been received. Insights on the targeting performance of input vouchers also help further the literature on decentralized targeting more broadly. There have been few studies from African settings and most have focused on studying targeting performance with respect to reaching the poor.

To assess the targeting performance of a program one must know who the intended beneficiaries are. When it comes to input vouchers, these are in practice, however, not always clearly defined. As Wiggins and Brooks (2010) highlight, input voucher programs (implicitly or explicitly) often pursue both an economic objective—boosting aggregate output—and a social one—raising incomes among poor smallholders. To boost aggregate output, vouchers should be directed to farmers with the highest marginal productivity for input use. But, those are not necessarily the poorest. Smallholders may display a high marginal productivity and be poor, for example, when they use few inputs largely due to credit and insurance constraints (Dercon & Christiaensen, 2011). But, they may also already use modern inputs and display a lower marginal productivity, while still being poor, for example, because they possess too little (and infertile) land to generate a viable livelihood. Consequently, the performance of community based targeting may well depend on the yardstick used. Elite capture may then deteriorate the targeting performance if poverty is the criterion, but not necessarily so when marginal productivity is the yardstick.[2]

Overall, in this study, households with elected village officials, who can be seen as members of the local elites, received about 60% of the distributed vouchers and multivariate analysis confirms that being a member of the local elite, significantly increases the likelihood of receiving a voucher, that is after controlling for the program's official eligibility criteria and the program's (dual) objectives. Follow up analysis of the targeting performance, shows that local elite capture also substantially reduces the targeting performance of the program, especially when poverty is the targeting criterion. This lends credence to the lingering concerns about elite capture in the literature on decentralized targeting and its negative effects on targeting performance.

These tendencies of elite capture are more pronounced in more unequal and remote communities, while the size of the program, as well as trust levels in the village, emerge as important counteracting factors, at least when poverty is the targeting criterion. The presence of extension agents on the other hand, appears less conducive to targeting non-users and those with higher marginal productivity. Overall, the findings highlight the continuing need for selectivity and scrutiny of the allocation process, also when relying on decentralized targeting. Larger singularity in objective, for example by only targeting those with a higher marginal productivity or the poor, or those who are both poor and highly productive at the margin, could further help in making input subsidies also market smart and cost-effective on the ground.

The remainder of the paper is organized around the two core questions addressed in this study: (1) whether local elites are indeed more likely to be beneficiaries of the decentralized voucher program; and if so, (2) whether this affects the targeting performance of the program. In particular, Section 2 describes how input vouchers are distributed in our sample study, and explores how local elites participate in the program. Section 3 then introduces a more explicit metric to examine the targeting performance of the program, followed by an exploratory analysis of key factors correlated with this performance, including the role of local elites. Section 4 concludes.

2. VOUCHER DISTRIBUTION IN PRACTICE AND THE ROLE OF THE LOCAL ELITE

(a) *The input voucher program in Tanzania*

Following the 2007/8 food crisis, the Government of Tanzania launched an input voucher pilot program in 56 districts to increase the production of two of its major staple crops—maize and rice—and enhance its national food security. The program was geographically targeted to areas most suitable for maize and paddy rice production, which are mainly concentrated in the Southern and Northern Highlands and the Western Region, while also taking into account the number of smallholder agricultural households who cultivated less than one hectare of maize or rice. As food prices remained high and volatile in the aftermath of the crisis, the program was expanded in 2009 to 65 districts for a period of 3 years, with the aim to reach 2.5 million households in 2012. The key features of the program and its implementation modalities are summarized below. For a detailed description see World Bank. (2009).

The input package distributed consisted of three vouchers: (1) one for one 50 kg bag of urea, (2) one for one 50 kg bag of Di-Ammonium Phosphates (DAP) or two 50 kg bags of Minjingu Rock Phosphate (MRP) with nitrogen supplement, and (3) one for 10 kg of hybrid or open-pollinated maize seeds or 16 kg of rice seeds, sufficient for half a hectare of maize or rice. Vouchers for each input had a face value equivalent to 50% of the market price of the respective input.[3] The remaining 50% was to be paid by the farmers.

The central government allocates the vouchers to the target regions, which subsequently distribute it to their districts, which in turn distribute it to the villages in their district. At each level of government a special voucher committee is set up to allocate the vouchers to the lower levels based on the ex-

pected demand for inputs using historical production data for maize and rice as well as other related information such as the number of smallholder farmers who grow maize and rice and the average land size per farmer.

The last step in the distribution is at the village level. First, the village council, in consultation with the village assembly,[4] organizes the election of the Village Voucher Committee (VVC), which should consist of three men and three women. Then, the VVC draws up a list of beneficiary farmers for approval by the village assembly. After approval, the VVC issues the vouchers to the approved farmers, who can redeem them with local agro-dealers participating in the program.

According to the guidelines given, the VVC should select farmers that (1) are able to co-finance the inputs purchased with the voucher; (2) are literate and (3) do not cultivate more than 1 ha of maize and/or rice; with priority to be given to female headed households and households who have used little or no modern inputs on maize or rice over the past 5 years. As such, these criteria reflect the implicit dual objective of the program: (1) increase overall maize and rice output (e.g. by focusing on non-input using, literate farmers who are more likely to have a higher marginal productivity) and (2) increase access to modern inputs among poor and vulnerable smallholders (e.g. by giving priority to female headed households). A more detailed empirical comparison of both groups, their differences and overlap, is provided in Section 3.

(b) *Voucher beneficiaries in Kilimanjaro*

How the village communities have been selecting the voucher beneficiaries given these official guidelines and how this has affected the targeting performance of Tanzania's input voucher program given its overarching objectives of increasing aggregate output and reducing poverty is explored here using data from the Vulnerability Household Panel. The latter has been conducted in the Kilimanjaro region of Tanzania in 2003, 2004, and 2009.[5] Kilimanjaro is a well-connected and dynamic coffee growing region located in the Northern Highlands, where maize is an important staple. It consisted of 5 districts in 2003 (one district was split up later on into two) and the sample was designed to be representative for all agricultural households in rural Kilimanjaro. In the first round, conducted in November–December 2003, 954 households were surveyed in 45 villages, selected using the probability proportional to size procedure, or about 21 households per village. Households were revisited in November-December 2004 and 2009, with little attrition in 2004 (915 households surveyed), though a significant loss of households in 2009 (772 households interviewed). To correct for under-representation due to attrition of households with certain characteristics, the sampling weights of the remaining households were adjusted.[6]

Each round of surveys comprises a comprehensive community and household survey with most of the modules identical across rounds. The data in the third round capture the results of the 2008/9 agricultural season, which coincides with the first year of the expanded voucher program. A special module about the input voucher was added to the household questionnaire, including questions about whether households were determined as eligible by the village, their actual uptake as well as the kinds of vouchers received.

The total number of vouchers received by the village was recorded in the community survey. Vouchers were distributed in 39 out of the 45 villages and in each of these villages about a quarter of the households received at least one voucher. The sample households can be divided in three groups (Table 1): (1) households whom the village determined non-eligible for the input vouchers; (2) households determined eligible, but who did not redeem the vouchers; and (3) households determined eligible who did redeem the voucher. As most eligible households also redeemed the voucher, the middle group is small (only 18 households out of 170 eligible households did not redeem the voucher) and the focus in the multivariate analysis will be on being eligible (interchangeably labeled beneficiary).

To shed first light on the criteria used in practice to identify the beneficiaries, the three groups of households are compared along a number of factors that have been posited in the literature to affect eligibility. These obviously include (1) the program design factors mentioned above (ability to co-finance, literacy, cropping pattern, gender of household head, and past input use); but also, (2) program objective related factors such as efficiency (having high marginal productivity for input use) and equity (poverty); (3) sociological factors such as community homogeneity, trust, and ethnicity; (4) village characteristics to explore geographic targeting criteria, and last but not least, (5) politically oriented factors such as being (or being associated with) local elite, being informed, feeling empowered. Where appropriate (and available), information preceding the voucher uptake is used, i.e. the value of the indicator from the second as opposed to from the third survey round. Robustness tests to the timing of these indicator values, using predicted values for 2008, will be undertaken when examining the targeting performance more explicitly in Section 3.

Consistent with the program guidelines (Table 1, panel 1), voucher beneficiaries were more likely to have the necessary matching funds as suggested by their larger membership in financial institutions. The large need for credit and limited formal membership in financial institutions of eligible households who eventually did not redeem the voucher suggests that access to matching funds has been an issue for some. The beneficiaries were also less likely to be illiterate, though the difference was not statistically significant. They were also more likely to have planted maize/rice. But, contrary to the guidelines, they were more likely to have cultivated more than 1 ha of maize and/or rice; a larger share was male (as opposed to) female headed and many more had already used modern inputs in the past. Overall, this suggests rather partial compliance with the guidelines.

Turning to the dual objective of most input voucher programs (increasing overall output and improving poor smallholders' productivity and income), the second panel of Table 1 examines differences in marginal productivity of modern input use and poverty incidence among voucher beneficiaries and non-beneficiaries. The marginal productivities (in 2003 prices) of inorganic fertilizers and seeds are derived for each household from the Cobb–Douglas production functions estimated with household fixed effects using the 2003 and 2004 surveys (see Appendix A1 and Table 8 for details).

Contrary to the optimal targeting rule for increasing aggregate production, vouchers are going disproportionately to households with a lower marginal productivity for modern input use. The difference is substantial, with the marginal productivity among households that receive vouchers 50–320% lower than among households that are not eligible for vouchers.[7] Voucher beneficiaries also tend to be less poor, with more land. In other words, decentralized targeting does not appear to perform well on either of the program's objectives.

A review of the sociological factors suggests that Chagga households (who are more prevalent in the richer northern districts) are more likely to receive vouchers than Pare households (who are more prevalent in the poorer southern district), though there is no discernable difference based on

Table 1. *Political, program design, program objective, sociological, and village factors all affect the input voucher distribution*

Means for continuous variables; ratios for dummy variables	Not eligible	Eligible and not redeemed	Eligible and redeemed[a]
No. of obs.	602	18	152
Program design factors			
Household head is illiterate (1 = yes)	0.142	0.042	0.108
Belongs to savings and credit cooperative (SACCO (1 = yes)	0.184	0.206	0.312***
Has a bank account (1 = yes)	0.138	0.087	0.231**
Needs credit to buy agriculture inputs in 2009 (1 = yes)	0.135	0.227	0.180***
Whether planted maize/rice in 2004 (1 = yes)	0.551	0.730	0.745***
Whether land was cultivated with maize and rice in 2004 < 1 ha (1 = yes)	0.922	0.751	0.828***
Gender of household head (1 = male)	0.844	0.817	0.891*
Whether used improved seeds in 2004 (1 = yes)	0.499	0.604	0.686***
Whether used inorganic fertilizer in 2004 (1 = yes)	0.303	0.604	0.559***
Program objectives			
Marginal productivity of improved seeds in 2004 (1,000 Tsh/kg)	3.539	1.658	2.358*
Marginal productivity of inorganic fertilizer in 2004 (1,000 Tsh/kg)	4.332	0.634	1.021***
Marg. productivity of improved seeds in 2004 (maize and rice) (1,000 Tsh/kg)	0.699	0.514	0.472
Marg. productivity of inorganic fertilizer in 2004 (maize and rice) (1,000 Tsh/kg)	0.854	0.665	0.428**
Poor in 2004[b] (1 = yes)	0.52	0.49	0.38***
Total income per adult equivalent in 2004 (1,000 Tsh)	119	104	168
Land cultivated in 2004 (acre)	1.016	1.228	1.251
Sociological factors			
Age of household head	58	56	58
Chagga	0.728	0.528	0.841***
Pare	0.202	0.228	0.081***
Christian	0.876	0.592	0.903
Trust[f]	0.170	0.114	0.107**
Village characteristics			
Distance to town (km)	13	17	12
Whether there is bus to town (1 = yes)	0.563	0.285	0.502
Whether there is market in town (1 = yes)	0.292	0.285	0.248
Whether there is agr input shop in village (1 = yes)	0.265	0.046	0.240
Whether there is extension agent in village (1 = yes)	0.872	0.948	0.833
Political factors			
Member of household has elected position in village (1 = yes)	0.375	0.440	0.575***[a]
Member of household is in village voucher committee (1 = yes)	0.037	0.049	0.145***
Listens to/read/watch radio, TV, newspaper, internet[c] (1 = yes)	0.817	0.805	0.914***
Participate in public meetings, farmer's association, talk to government officials[d] (1 = yes)	0.492	0.720	0.647***
Has the power to make important decisions of life[e] (1 = yes)	0.479	0.422	0.619***

Note: For the variables of marginal productivities, total income per adult equivalent, land used for maize and rice, distance to town, medians are reported. For all other continuous variables, means are reported and proportions for the dummy variables.

[a] ***, **, * The hypothesis mean (not eligible) = mean (redeemed) or ratio (not eligible) = ratio(redeemed) is rejected at the 1%, 5%, 10% level, respectively.

[b] Based on food energy intake poverty line calculated by Christiaensen and Pan (2010).

[c] Dummy variable, 1 = listens to/read/watch radio, TV, newspaper, internet at least once a month.

[d] Dummy variable, 1 = participates in public meetings, farmer's association, talks to government officials at least once a month.

[e] Dummy variable, 1 = somewhat or mostly able to make important decisions of life.

[f] Dummy variable, 1 = strongly or somewhat agrees that most people can be trusted.

religion. More trusting individuals on the other hand, see themselves left with less vouchers (7% points). There appear no systematic differences in the village characteristics of beneficiary and non-beneficiary households.

Finally, the last panel in Table 1 examines whether local elites (and those closely associated with them) are indeed more likely to be voucher beneficiaries, one of the focus questions of the study. Much of the literature on decentralized targeting has derived conclusions about elite capture based on indirect evidence inferred from the estimated relation between within community inequality and targeting performance (Bardhan & Mookherjee, 2005, 2006; Galasso & Ravallion, 2005). Here we explore this question more directly by examining whether those likely to belong to or being associated with the local elites, such as households who have members holding elected positions in the village[8] or households who have a member in the VVC, are also more likely to be selected as beneficiaries.

The likelihood of being eligible for a voucher is much larger among households with elected village officials (20% points larger) and among VVC members (10% points larger). Illustrated in another way (figures not reported in the table), while the average proportion of households eligible for a voucher package in a village is 26%, among households with an elected household member 35% is eligible and among households with a VVC member 47% is eligible. This would suggest that being a member of the local elite does indeed affect voucher eligibility. As a matter of fact, on average, 60% of all vouchers distributed goes to households with elected officials and 16% to

Table 2. *Elected officials and VVC members are less poor, display lower marginal productivity, and are less compliant with most of the program's selection criteria*

Means for continuous variables; ratios for dummy variables	Elected officials	VVC members	Others
Program guidelines			
Household head is illiterate (1 = yes)	0.229	0.138	0.299
Years of education of household head	5.217**	5.942***	4.654
Belongs to savings and credit organization (1 = yes)	0.320***	0.376***	0.120
Has a bank account (1 = yes)	0.183*	0.256*	0.129
Needs credit to buy agriculture inputs in 2009 (1 = yes)	0.148***	0.116	0.081
Whether land was used for maize and rice in 2004 < 1 ha (1 = yes)	0.883*	0.935	0.909
Planted maize or rice in 2004 (1 = yes)	0.663***	0.619	0.551
Gender of household head (1 if male)	0.941***	0.977***	0.786
Whether used improved seeds in 2004	0.624***	0.764***	0.476
Whether used inorganic fertilizer in 2004	0.407**	0.522***	0.329
Program objectives			
Marginal productivity of improved seeds in 2004	2.618	2.197	3.618
Marginal productivity of inorganic fertilizer in 2004	3.546	2.372	3.797
Marginal productivity of improved seeds on maize/rice in 2004	0.548	0.324*	0.759
Marginal productivity of inorganic fertilizer on maize/rice in 2004	0.684	0.251	0.818
Total income per adult equivalent in 2004	141.118	172.124***	113.222
Poor household (1 = yes)	0.456**	0.432	0.523
No. of obs.	331	41	434

Note: For the variables of marginal productivities, total income per adult equivalent, land used for maize and rice, medians are reported. For all other variables, means (continuous variables) or ratios (dummy variables) are reported.
* The hypothesis mean (elected officials/VVC members) = mean (others) is rejected at the 10% level respectively.
** The hypothesis mean (elected officials/VVC members) = mean (others) is rejected at the 5% level respectively.
*** The hypothesis mean (elected officials/VVC members) = mean (others) is rejected at the 1% level respectively.

those who are members of the VVC. Yet, most VVC members are also elected officials and together they have been assigned 60% of all vouchers.

Could this explain the somewhat limited compliance with the program guidelines and the weak performance in targeting by the program's objectives? The bi-variate results in Table 2 would seem to suggest so. On the one hand, the local elites are indeed more likely to meet the co-financing requirements (Table 2), as suggested by the larger proportion of households with elected officials and VVC members belonging to a Saving and Credit Association (SACCO) or having a bank account. But, even though they are more educated, the difference in literacy with the rest of the village population is not statistically significant. And, contrary to the guidelines, they are also more likely to have cultivated more than 1 ha of rice and maize and to have used seeds and fertilizer in the past. A larger proportion of their households is also male headed. When it comes to the program's objectives, they are less poor and more likely to display a lower marginal productivity, though the latter difference is not statistically significant.

In an interesting recent paper examining the targeting performance of Tanzania's Social Action Funds, its flagship Community Driven Development program, Baird, McIntosh, and Ozler (2011) show that it is especially access to information and engagement in local politics that proved to be crucial in the allocation of the funds. Similarly in this sample, the better informed, i.e. those who access public media more frequently and those who interact more frequently with public institutions, also have a higher likelihood of being eligible for the voucher (by 10–15% points) (Table 1). Those who are better "plugged in" in village politics and better informed about new initiatives, such as the voucher program, may be more inclined to try to influence the voucher allocation process and lobby the VVC members (including by influencing the selection of VVC members themselves). This may also be the channel through which the local elites increase their share of access to the voucher.

In sum, the bi-variate analysis suggests that the targeting on the ground has only been in partial compliance with the guidelines on paper and that the overall targeting performance is far from optimal when compared with the program's dual objectives. In addition, members of the local elite or those closely associated with it are receiving a disproportionate share of the vouchers.

(c) *Local elites and the voucher committee members*

To further explore whether belonging to or being associated with the local elite as such affects the likelihood of being eligible for a voucher, or whether it merely reflects other factors that simultaneously affect eligibility and belonging to the local elite (such as being aware/informed or being more likely to meet the co-financing requirement), a multi-variate analysis is pursued. In particular, let

$$V_{vh} = P(\alpha E_{vh} + \beta H_{vh} + \gamma M_v + C + \varepsilon_{vh}), \quad (1)$$

with V a dummy variable indicating whether household h in village v was selected as beneficiary/eligible for a voucher and $P(.)$ the cumulative distribution function of a standard normal distribution, E a set of variables indicating whether a household holds elected office or belongs to the VVC, H a set of household characteristics reflecting other political, program design, program objective, and sociological factors that are considered to affect eligibility and may also affect being part of the local elite (such as education and being aware), M a set of village dummies that control for village characteristics that may affect voucher distribution within villages as well as those that may affect voucher distribution across villages, C a constant, and ε the error term. A positive statistically significant coefficient α on E would indicate that local elites are more likely to be eligible for vouchers as such, irrespective of their awareness, or the guidelines or whether they are more likely to meet the program objectives, pointing to

Table 3. *Local elites are more likely to be eligible for vouchers and to belong to the VVC*

Probit estimates (marginal effects reported)	Eligible for vouchers Marg. effects/SD	Village voucher committee Marg. effects/SD
Political factors		
Belonging or being associated with local elite		
Member of household has elected position in village	0.1104**	0.0699***
	(0.0406)	(0.0195)
Member of household is in village voucher committee	0.2670**	
	(0.1024)	
Awareness and empowerment		
Listens to/reads/watches radio, TV, newspaper, internet	0.0198	−0.0189
	(0.0537)	(0.0223)
Participates in public meetings, farmer's association, talks to govt officials	0.1019**	0.0286**
	(0.0375)	(0.0115)
Has the power to make important decisions of life	0.0718*	0.0127
	(0.0371)	(0.0109)
Program design factors		
Household head is illiterate	−0.0494	−0.0159
	(0.0619)	(0.0155)
Whether land was used for maize/rice in 2004 < 1 hectare	−0.1998**	0.0046
	(0.0862)	(0.0145)
Whether planted maize/rice in 2004	0.023	−0.0147
	(0.0418)	(0.0129)
Belongs to SACCO	0.0229	0.0099
	(0.0490)	(0.0175)
Has a bank account	0.1081	0.0008
	(0.0661)	(0.0158)
Gender of household head (1 if male)	−0.0047	0.0235**
	(0.0551)	(0.0118)
Whether used improved seeds in 2004	0.0517	0.0107
	(0.0446)	(0.0165)
Whether used inorganic fertilizer in 2004	0.0648	0.0053
	(0.0559)	(0.0151)
Program objectives		
Marginal productivity of improved seeds on maize/rice in 2004	0.005	−0.003
	(0.0054)	(0.0050)
Marginal productivity of inorganic fertilizer on maize/rice in 2004	0.0086	0.0002
	(0.0087)	(0.0030)
Poor household (1 if yes)	−0.0521	−0.0068
	(0.0364)	(0.0100)
Sociological factors		
Age of household head	−0.0009	−0.0003
	(0.0014)	(0.0004)
Years of education of household head	−0.0145**	0.0004
	(0.0064)	(0.0020)
Chagga	−0.05	−0.0043
	(0.1047)	(0.0198)
Pare	−0.0691	−0.0296**
	(0.0945)	(0.0113)
Christian	−0.0944	
	(0.0830)	
Trust	−0.0714	0.008
	(0.0437)	(0.0165)
Village dummies	Yes	No
Pseudo *R*-squared	0.24	0.20
No. of Obs.	642	642

Note: All variables are dummy variables, except marginal effects, age, and education of household head. Marginal effects are reported, and standard deviations (SD) are reported in the brackets. Weights correcting for attrition (Footnote 13) are used in all regressions.

* denotes significance at 10% level.

** denotes significance at 5% level.

*** denotes significance at 1% level.

their independent/political role in the voucher distribution. The results from estimating Eq. (1) using probit estimation are in Table 3.

Strikingly, after controlling for other political, program design, program objective and sociological factors, as well as village characteristics, holding elected office and being a member of the voucher committee are still strongly associated with voucher eligibility. Ceteris paribus, members of the VVC are 27% points more likely to be eligible for a voucher, and those holding elected office 11% points. Belonging to the local elite thus affects the voucher allocation beyond the other factors, including those reflecting public awareness/being informed and one's sense of being empowered, which are also highly correlated with being selected as a voucher beneficiary, echoing the findings by Baird et al. (2011).

Once being local elite and awareness and empowerment have been controlled for, none of the program design criteria appears to affect eligibility, with the exception of the amount of land cultivated with rice/maize, with those cultivating more than 1 ha appearing to be more (as opposed to less) likely to be eligible. The coefficients on the targeting criteria derived from the project objectives (marginal productivity and poverty) or the sociological factors are also not significant. Controlling for literacy, more educated household heads are less likely to be eligible, a result which is possibly driven by the highly educated who are likely substantially richer and more focused on other remunerative activities.

As VVC members appear to have such a head start in being selected as voucher beneficiary, the correlates of being a VVC member are further explored, again using the probit estimator (Table 3).[9] Elected officials are 7% points more likely to be VVC members, giving them an additional edge to be eligible for the voucher (over and above their direct advantage). VVC membership is slightly higher among those participating in the meetings and contrary to the guidelines, also among male headed households. Finally, Pare households appear slightly disadvantaged in being VVC members. None of the other program designs, program objectives, or sociological variables were significant, indicating that the VVC members were not more likely to be selected as beneficiary because they were systematically more likely to meet the official guidelines, which in fact they were not (Table 2).

Clearly, being a VVC member substantially increases one's chances of being a voucher beneficiary. Yet, the task of being a VVC member is unfunded, and reception of a voucher is likely seen as a form of compensation (Coady et al., 2004). If this is the case and given that they take up 16% of the vouchers, the composition of the VVC becomes important. From this perspective, the adopted adjustment of the VVC membership rules to exclude village leaders and increase female participation after the pilot phase was clearly warranted. But, implementation remains wanting.

In addition, the large independent effect of being (associated with) local elite on voucher eligibility suggests a pre-occupation with serving one's own group first. And once the elected officials have been served, more selectivity may be introduced. This would suggest that the more vouchers there are in a village for distribution, the better the targeting performance will be, a hypothesis explored further below.

The bi-variate and multi-variate analyses of voucher eligibility presented so far indicate that being elite significantly increased the likelihood of being eligible for vouchers, irrespective of the official targeting criteria and the program's objectives. How does elite capture then affect the overall targeting performance of the voucher program, the second core question of the study? To answer this question more directly and enable a more comprehensive analysis of the factors affecting the communities' targeting performance, an explicit targeting metric is introduced in the next section, the targeting differential.

3. TARGETING PERFORMANCE

(a) *The targeting differential*

Following Galasso and Ravallion (2005), three measures of targeting are defined:

$$G^p = \frac{s_{11}}{H}, \quad G^n = \frac{s_{12}}{1-H}, \quad T = G^p - G^n \tag{2}$$

where H is the proportion of all households in the targeted group, s_{11} is the proportion of all households that are in the targeted group and receive the program, s_{12} is the proportion of all households who are not in the targeted group but still receive the program. G^p and G^n therefore measure the proportions of households in the targeted group that receive the program and the proportion of households not in the targeted group that receive the program respectively. The difference between the two measures is the targeting differential, T.

If the program is perfectly targeted to the ones in the targeted group, the untargeted group receives nothing, and the targeted group is completely covered, then $T = 1$; if the program only, but fully, reaches the non-targeted group, then $T = -1$; a uniform allocation (no targeting) implies $T = 0$. If proportionately more of the targeted than the untargeted group is reached, then $0 < T < 1$. This also holds if the program is not large enough to fully cover the targeted group, even though there is no leakage to the non-targeted group. If the program reaches proportionately more of the untargeted than the targeted group, then $0 > T > -1$.

In addition, Ravallion (2000) shows that the targeting differential at the region level can be decomposed into an "intra-village" and an "inter-village" component using the following equation:

$$\overline{T} = \underbrace{\frac{\sum_v \sum_h (G_{hv} - G_v)(H_{hv} - H_v)}{\sum_v \sum_h (H_{hv} - H)^2}}_{\text{(intra-village)}} + \underbrace{\frac{\sum_v N_v (G_v - G)(H_v - H)}{\sum_v \sum_h (H_{hv} - H)^2}}_{\text{(inter-village)}}, \tag{3}$$

where h is a household index, v is a village index, and N_v is the number of households in village v. G_{hv}, G_v, G are the percentage of households reached by the program in each household, village, and the region respectively. H_{hv}, H_v, H are the percentage of households in the targeted group in each household, village, and in the region, respectively.[10] This decomposition enables us to measure which component is dominant in the targeting of the program.

The relation between village characteristics and the village level targeting differentials is then explored using the following equation:

$$T_v = \pi X_v + C^T + \varepsilon_v^T, \tag{4}$$

where T_v is the targeting differential at the village level, X is a set of village level political, socio-economic, social, and program design factors explored in the literature as affecting targeting performance (Bardhan & Mookherjee, 2000, 2005, 2006; Chavis, 2010; Galasso & Ravallion, 2005; Park & Wang, 2010), C^T is a constant and ε_v^T is the error term.

(b) *Rather limited targeting after all*

As both equity and efficiency concerns drive Tanzania's smart input voucher program, the targeting performance is evaluated here based on the following criteria: (1) whether the voucher program targets the poor, (2) whether it targets those with high marginal productivity of input use, (3) whether it targets poor households that also have high marginal productivity, and (4) whether it reaches households that did not use improved seeds and inorganic fertilizers before. The latter category is potentially an important target group for market smart subsidies, as it is likely to meet both the equity and efficiency criteria (Ricker-Gilbert, Jayne, & Black, 2009). It is also given priority by the official program guidelines.

To analyze the targeting performance based on poverty, the poverty line calculated in Christiaensen and Pan (2010) was used, as before. According to this measure, about half the population would have been eligible for a voucher. [11] For targeting based on efficiency, the median values in each village of the households' marginal productivity of improved seeds and fertilizer on maize/rice (as observed in the previous survey round) are used as cut-offs. This implies that half of the population is considered as target population. Non-users of improved seeds and fertilizers make up about 50% and 67% of the households in the previous survey round respectively. [12]

Cross-tabulation of the different groups confirms that the overlap among them is far from complete. The targeting performance is thus likely to depend on the criterion used. First, there is little correlation between poverty and productivity. Only 54 (52)% of households are either poor with high marginal productivity for seeds (fertilizer) or non-poor with low marginal productivity. About 25% of the sample has high marginal productivity while also being poor. This is arguably the preferred target group of the program, i.e. poor smallholders with a large potential to raise aggregate output. Targeting this group has the advantage of making little inclusion error, especially if the number of vouchers is limited, even though it would exclude about half of the poor and half of the highly productive.

With 56% of the sample being poor non-input users or non-poor input users, the correspondence between poverty and non-input use is slightly higher. There is very good correlation between non-input use and marginal productivity, with highly productive non-seed (fertilizer) users and low productive-seed (fertilizer) users together making up 82 (73)% of the total sample population. This provides some support for using previous input use as targeting indicator— the variable is relatively easy to observe and non-users are more likely to be poorer smallholders with a high marginal productivity. Potential displacement of commercial input purchases, a continuous concern with input subsidies (Ricker-Gilbert, Jayne, & Chirwa, 2010) is also a non-issue for this latter group, thereby increasing additionality and cost effectiveness of the voucher program.

Turning to the targeting performance in our sample, it appears that it is worse than uniform (or no) targeting when it comes to targeting the poor or the non-users, especially non-users of inorganic fertilizers (Table 4, column 1). When considering poor households with high marginal productivity, the program's targeting is not really different from uniform targeting ($T = 0$). It is only marginally better when considering marginal productivity alone as targeting criterion. The latter result follows from better targeting performance within the villages (the intra village targeting differential displaying a positive sign for targeting by marginal productivity), while regressive targeting both within and across villages contributes to the poor targeting performance along the other two criteria (poverty and previous non-use).

The performance evaluation presented here uses values of the targeting criteria of the previous survey round. These have the clear advantage of being unaffected by the voucher program. They may however be somewhat inaccurate if the households' poverty status, productivity, and input use fluctuate considerably from year to year. Use of predicted pre-season 2009 values of the targeting indicators (as opposed to the observed 2009 values, which are obviously endogenous) (Table 9) [13] leads to similar conclusions about the program's targeting performance, indicating robustness of the findings.

(c) *Elite capture undermines targeting efficiency*

The last column in Table 4 reports for each targeting criterion the average (and standard deviation) of the within village targeting differentials across the sample. The relatively high standard deviation (around 0.2) suggests a substantial difference in targeting performance across villages. [14] To explore why some villages appear better at targeting than others, these within village targeting differentials are regressed against a limited set of political, social, program design, and service provision factors. The choice of these village level correlates was guided by the (limited) literature on decentralized targeting reviewed above. Given the relatively small number of villages in the sample, the number of factors considered is deliberately kept to a minimum. Table 5 shows the summary statistics of these factors.

The number of vouchers per village for which households with an elected official or a VVC member were eligible is included to examine the potential role of elite capture. Across villages, the number of vouchers in a village for which (sample) households with elected officials and VVC members were eligible ranges between 0 and 10, with the median situated around 2.4. When expressed in terms of shares of the total number of vouchers for which households with elected positions and VVC members were eligible, it ranges from 16% for the 10th percentile village to 100% for the 75th percentile village. [15]

Two other politically oriented variables included are the Gini measure of within village (land) inequality and a measure of awareness. The former has often been used to reflect power structures (Araujo et al., 2008; Bardhan & Mookherjee, 2006) and facilitates comparison with the literature. The latter may either increase overall accountability and thus the targeting performance (Bardhan & Mookherjee, 2000; Park & Wang, 2010), or decrease it, if it only privileges those that are better informed, reflecting "information capture" (Baird et al., 2011). Awareness is proxied through the proportion of households regularly using public media. This is relatively high, with in each of the sample villages more than half the village population (57%) consulting public media at least once a month. [16]

Village education levels are also regularly considered in examining targeting performance (Galasso & Ravallion, 2005). While illiteracy among household heads is generally low (quasi non-existent in almost half the villages), it still reaches 42% in the most illiterate village. In a novel addition to the targeting literature, the level of trust households in a village have in others is further included as a correlate of social cohesion. The proportion of households in a village who (somewhat or strongly) agree that most people can be trusted (arguably a rather demanding measure of trust) ranged between zero and 33% with the median situated around 17%. Clearly, trust levels are higher in some communities than others.

Table 4. *Targeting differentials by different targeting criteria*

Targeting criterion	$\overline{T}_{overall}$ (1)	$\overline{T}_{intra}$ (2)	$\overline{T}_{inter}$ (3)	$T_{village}$ (4)
Targeting by poverty				
FEI poverty line[a]	−0.090	−0.055	−0.034	−0.049
				(0.193)
Targeting by efficiency				
High marginal prod. seeds [b]	0.051	0.051	−0.001	0.062
				(0.198)
High marginal prod. fertilizer[c]	0.024	0.025	−0.002	0.024
				(0.246)
Targeting by efficiency AND poverty				
High marginal prod. seed and poor (FEI)	−0.029	−0.023	−0.006	0.011
				(0.255)
High marginal prod. fertilizer and poor (FEI)	0.003	−0.050	0.054	−0.029
				(0.259)
Targeting by past use				
Past non users of improved seed	−0.096	−0.055	−0.041	−0.060
				(0.202)
Past nonusers of fertilizer	−0.191	−0.057	−0.134	−0.055
				(0.237)

Note: For column (4) means of the variables per village are reported. Standard deviations are reported in the brackets.
[a] The poverty line is the food-energy-intake poverty line taken from Christiaensen and Pan (2010).
[b] Households with marginal productivity of improved seeds bigger than the village median are defined as productive in using improved seeds.
[c] Households with marginal productivity of inorganic fertilizer bigger than the village median are defined as productive in using inorganic fertilizer.

Table 5. *Correlates of decentralized targeting performance*

	Min	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile	Max
Political factors							
# vouchers per village for which sample households with elected positions and VVC members were eligible [a]	0.00	1.06	1.22	2.42	4.34	5.91	9.59
Share of vouchers for which households with elected positions and VVC members were eligible	0.00	0.16	0.40	0.60	1.00	1.00	1.00
Land inequality (Gini index)	0.24	0.32	0.37	0.42	0.49	0.53	0.99
% that listen to/read/watch radio, TV, newspaper, internet[b]	0.57	0.71	0.79	0.87	0.92	0.94	1.00
Social factors							
% with illiterate household head	0.00	0.00	0.00	0.07	0.15	0.25	0.42
%Trust[c]	0.00	0.06	0.11	0.17	0.21	0.27	0.33
Program design factors							
# vouchers per village received by sample households per village[a]	1.02	1.44	2.42	4.68	7.41	9.80	14.9
Socio-economic environment							
Agricultural extension agent	0.00	0.00	1.00	1.00	1.00	1.00	1.00

[a] Corrected for attrition using attrition weights from Footnote 13.
[b] Dummy variable, 1 = listens to/reads/watches radio, TV, newspaper, internet at least once a month.
[c] Dummy variable, 1 = strongly or somewhat agrees that most people can be trusted.

An important program design feature that has been reported to affect performance is the scale of the program (Bardhan & Mookherjee, 2005; Galasso & Ravallion, 2005). This is proxied by the number of (attrition corrected sample) beneficiary households per village, which ranges between 1 and 15. The median is 4.7. Finally, given the important role of extension agents in the distribution of the vouchers, whether there is an extension agent in the village is also controlled for. Extension agents are located in about three quarters of the villages.

The relation between the intra-village targeting differential and these village level factors is estimated for the targeting differentials based on poverty, marginal productivity, and new input usage (Table 6). As −1 and 1 are the maximum values of the targeting differential, representing "corner solutions", the tobit estimator is used (Wooldridge, 2002).

The larger is the number of vouchers going to elected village officials and VVC members in a village (controlling for the number of beneficiary households), the worse is the targeting performance. In other words, not only are elected village officials much more likely to be eligible for vouchers, as demonstrated before, this also substantially reduces the targeting performance. As expected, the effects are most detrimental when targeting by poverty—elected village officials tend to be less poor. But targeting effectiveness also tends to decline when efficiency is the overriding concern, in particular for seeds when targeting based on marginal productivity or for fertilizer when aimed at bringing in new users. At the margin, village elected officials are usually not the more efficient input users.

After controlling for voucher eligibility by elected officials, no relation is found between land inequality and targeting

Table 6. *Factors affecting targeting performance at the village level*

Targeting differential T_v based on following targeting criteria using Tobit estimator	Poverty[a] (PL = FEI)	Marginal productivity of seeds	Marginal productivity of fertilizer	New-seed user	New inorganic fertilizer user
Political factors					
# vouchers captured by households with elected positions and VVC members	−0.068***	−0.044**	0.036	−0.005	−0.063*
	(0.020)	(0.019)	(0.043)	(0.030)	(0.035)
Land inequality (Gini index)	0.226	0.290*	−0.370	0.103	0.358
	(0.327)	(0.166)	(0.232)	(0.272)	(0.300)
% of villagers listening to the radio/watching TV/reading the newspaper/using the internet at least once a month	0.079	0.631**	0.631*	−0.733*	−0.780***
	(0.236)	(0.306)	(0.379)	(0.421)	(0.282)
Social factors					
% of villagers with illiterate household head	0.209	1.017***	0.351	−0.276	−0.191
	(0.371)	(0.211)	(0.414)	(0.410)	(0.487)
% of villagers having high level of trust in others	1.030**				
	(0.449)				
Program design factors					
# vouchers received per village	0.053***	0.024**	−0.013	0.009	0.029
	(0.013)	(0.012)	(0.022)	(0.017)	(0.023)
Socio-economic environment					
Agricultural extension agent present in village	−0.119	0.011	−0.203***	−0.203***	−0.102*
	(0.241)	(0.099)	(0.066)	(0.059)	(0.061)
_cons	−0.397	−0.744***	−0.210	0.715**	0.589**
	(0.375)	(0.262)	(0.300)	(0.339)	(0.260)
N	37	37	37	36[b]	32[b]
F	4.069	8.968	2.388	8.254	5.339

Note: Standard deviations are reported in the brackets.
Weights calculated in Footnote 11 are aggregated at the village level and used in all regressions.
* Denotes significance at 10% level.
** Denotes significance at 5% level.
*** Denotes significance at 1% level.
[a] Poverty line taken from Christiaensen and Pan (2010).
[b] The sample size is smaller because some villages had no users of improved seeds and inorganic fertilizer in 2004 and the targeting differentials are not defined for these villages.

performance, except when it comes to reaching those with high marginal productivity for seeds, where it only has a significantly weak, positive effect. [17] As will be shown below (Table 7), intra-village inequality is highly correlated with the number of beneficiary households with elected officials, supporting the notion advanced in the literature that intra-village inequality negatively affects the performance of decentralized targeting through elite capture. Contrary to what has been hypothesized in the literature, in this sample, awareness, as proxied through use of public media, does not always result in better targeting. Better informed villages appear to be better at targeting vouchers to increase marginal efficiency, but also tend to target existing (as opposed to new) users and do not help in disproportionately reaching the poor.

Voucher coverage (i.e. the total number of voucher beneficiaries in a village) and trust appear to counteract the negative effects of elite capture, when reaching the poor is the criterion, with the negative effect of elite capture neutralized when the number of voucher beneficiaries is 28% larger than the number of voucher beneficiary households with elected officials or VVC members. [18] It suggests that the poverty targeting performance can be improved given sufficient coverage, at least when it comes to targeting by poverty, even though not when it comes to targeting by efficiency or non-use. These are important insights for a voucher program design.

Communities, where trust levels are higher, also tend to be better at reaching the poor (Table 6). [19] While no causality is purported here, it is unlikely that reverse causality drives this result. Trust takes long to build, but little to break, not the other way round (Williamson, 2000). The trust levels observed are thus unlikely to be the consequence of the experience with the input voucher program only. With the exception of targeting by marginal productivity of seeds, illiteracy levels were not found to affect the targeting performance.

Finally, the targeting performance by efficiency declines in villages where agricultural extension agents are present. They seem to be steering vouchers away from households with high marginal productivity of fertilizer use and non-users of modern inputs, maybe guided by the perception that many of the newcomers are ill placed to productively use such inputs. This suggests another area for attention in designing future voucher programs and their implementation modalities.

The findings bear out the lingering concerns in the literature about elite capture in decentralized targeting, with voucher coverage and allocation in high trust environments emerging as counteracting forces when overcoming poverty related market constraints, while the presence of extension agents may further exacerbate targeting inefficiencies, when increasing output is the objective. To further see how the political, social, and other factors indirectly affect targeting performance through the channel of elite capture, the number of beneficiary households with elected officials and VVC members is regressed directly on these factors in Table 7, again using the tobit estimator.

Table 7. *Factors affecting the number of vouchers allocated to elected officials and VVC members*

Tobit estimates	# vouchers per village for which sample households with elected positions and VVC members were eligible
Political factors	
Land inequality (Gini index)	2.409**
	(1.024)
% of villagers listening to the radio/ watching TV/reading the newspaper/using the internet at least once a month	1.145
	(2.399)
Social factors	
% of villagers with illiterate household head	−0.229
	(1.618)
% of villagers having high level of trust in others	−3.189
	(2.728)
Program design factors	
# vouchers received per village	0.405***
	(0.080)
Socio-economic environment	
Agricultural extension agent present in village	−0.073
	(0.493)
Distance to nearest town (km)	0.050***
	(0.018)
Constant	−1.523
	(2.085)
N	37
F	13.84

Note: Tobit estimates. Standard deviations are reported in the brackets.
** Denotes significance at 5% level
*** Denotes significance at 1% level.

First, the number of vouchers captured by the elite increases when the number of vouchers distributed increases, but at a rate of less than one, such that the ratio of vouchers captured by the elite decreases. This is consistent with the earlier observation that voucher coverage *can* increase targeting performance (at least among the poor). Second, elite capture of the vouchers also increases when intra-village land inequality goes up, providing support for the use of within village inequality indicators as proxy for elite capture. Finally, the further away from the rural towns, the more prone the allocation process is to elite capture.

4. CONCLUDING REMARKS

Input subsidy programs have once again become popular to increase agricultural productivity across Sub-Saharan Africa. Given that their fiscal burden can be high and typically increases over time, they only carry broad support to the extent that they address market failures, such as credit and insurance market failures, and to the extent that they generate multiplier effects by increasing aggregate output and reducing staple food prices. This presumes proper targeting, with decentralized targeting of input vouchers currently the preferred tool of choice to do so.

Decentralized targeting systems are attractive because they lower the cost of targeting by tapping into local knowledge. Yet, they have also been reported to suffer from elite capture. Using the experience from an input voucher program in Kilimanjaro, Tanzania, this study examined whether the dangers of elite capture are also real when distributing private goods such as input vouchers, if so, whether elite capture reduces the targeting performance of the program, and whether there are factors associated with mitigating these negative effects.

The results suggest that members of the local elite have indeed a higher likelihood of being voucher beneficiaries, partly through their disproportionate membership in the village voucher committee, instituted to propose the voucher allocation list within each village. The VVC members and the elected village officials together were eligible for about 60% of the distributed vouchers. While this ought not to be a problem as such, this "pre-allocation" of vouchers to the local elite had a strong negative effect on the targeting performance.

Occurrence of elite capture was more pronounced in villages with more unequal land distributions and in villages further away from the rural towns. Somewhat surprisingly, villages with extension agents were found to disproportionately steer vouchers away from new input users or households with higher marginal productivity in fertilizer use, in effect exacerbating the targeting inefficiencies induced by elite capture. When the focus was on fostering production among poor farmers, targeting performance improved when the number of vouchers distributed increased and when focused on villages where trust levels were higher.

Together these different factors resulted in a distribution of vouchers that was not fundamentally better than what uniform or random allocation would have yielded (or even worse when it concerned targeting the poor or non-users), despite the substantial efforts dispensed by both district and community committees. This relatively poor targeting performance undoubtedly also reflects the simultaneous pursuit of the program of multiple objectives (raising aggregate output versus raising poor farmers' income), each of which yields different targeting rules (targeting farmers with highest marginal productivity versus targeting poor farmers). This leads to a targeting practice focused on the lowest common denominator that tries to serve all in theory, but serves none well in practice. This was also reflected in the official program guidelines with some criteria (such as priority for female headed households and previous non-use) increasing the likelihood of identifying households that were both poor and highly productive, while others (such as the co-financing requirement) were reducing this.

Three core insights emerge for the future design and implementation of input voucher programs. First, the findings lend credence to existing concerns that under decentralized targeting schemes local elites tend to capture the benefits from the program, thereby also reducing its effectiveness. Second, they suggest that these tendencies can be counteracted with enhanced program coverage and a greater focus on higher trust settings when poorer farmers are targeted, and that greater selectivity and/or scrutiny is advised in relying on community based targeting in unequal and remote communities. The role of extension agents in affecting the program's targeting performance deserves also more explicit attention, especially when increasing overall output is the focus. Finally, clearer focus in objective could further help enhance the targeting performance of input voucher programs. This would also require the development of better proxies to target households with high marginal productivity. Previous non-use of inputs emerges here as a good candidate, though much more analysis is called for.

NOTES

1. In the past, input subsidy programs were usually universal. They not only proved to be fiscally unsustainable, larger farmers, who usually already have the know how and finance to use and purchase inputs, typically also do not need subsidies to adopt modern inputs, while subsidizing them would likely only outcrowd demand for commercial fertilizer, thereby neutralizing potential beneficial effects on input market development.

2. Even though they are more likely to use inputs already, elites may still display a higher marginal productivity for example if they also have access to irrigation or use better agronomic practices. Yet, they may also substitute subsidized fertilizer for commercial fertilizer, neutralizing the potential output effect and harming the development of input markets (Rickert-Gilbert et al., 2010).

3. The face values varied by district. Vouchers for each input are required to have a face value equivalent to 50% of the market price of the respective input, plus a "remoteness premium" that varies by the average distance of each district from the port (for urea and DAP) or point of production (for MRP and seed). In 2008/09, the face value of a voucher for a 50-kg bag of urea varied between TSh 24,000 for locations near Dar es Salaam and TSh 27,000 for more remote areas. For DAP, the face value ranged from TSh 45,000 to TSh 48,000.

4. The village assembly consists of all persons aged 18 and above, while the village council comprises of 15 to 25 members elected by the village assembly. The council consists of a chairperson, all chairpersons of the sub-villages within its area and other members elected by the village assembly. The term of office for all councillors is 5 years.

5. See Christiaensen and Sarris (2007) for a detailed description of the survey and sampling design.

6. Some households with only one elderly were lost due to the death of the person. Some households moved out of the village, and some households were not surveyed because they were working far away on their farms. To correct for potential attrition bias, we use two probit regressions to calculate the probability of a household being interviewed in round 2 and round 3 respectively. We then define a correction factor which is the inverse of the probability of being interviewed in round 2 or 3. If a household interviewed in round 1 has a high/low probability to be interviewed in round 2 or 3, its original sampling weight is multiplied by a lower/higher correction factor in round 2 or 3. Households with members with elected positions in villages are less likely to drop out in round 3. The weights of these households have been scaled down. The results of the probit regressions are available upon request.

7. Only when comparing the marginal productivity of improved seeds for maize/rice cultivation is the difference not statistically significant.

8. Elected positions in a village include village chairman, sub-village chairs, 10-cell leaders, members of village council and village execution officer.

9. Village level effects were not included this time as in some of the voucher receiving villages there were no VVC members in our sample. These would then be automatically dropped from the sample.

10. Note that if the household becomes part of the program $G_{hv} = 1$; $G_{hi} = 0$ otherwise. Similarly, $H_{hv} = 1$ if the household meets the targeting criterion; $H_{hv} = 0$ otherwise.

11. Using the median consumption per capita level of the region as the poverty line, as a robustness check, resulted only in a reclassification of 10 out of the 767 households.

12. By way of comparison, in 2003, 32% of the households used inorganic fertilizer, in 2004 35% and in 2009 39%.

13. In particular, the 2003, 2004, and 2009 survey rounds were pooled and separate ordinary least square regressions with household fixed effects were run to estimate the relationship between the households' poverty status, their marginal productivity, and input use (yes/no), respectively, and a series of (time variant) household and village characteristics (including for example median village level seed and fertilizer prices). A dummy variable for being a voucher beneficiary was also included, to control for the potential effect of the voucher use in 2009. The 2009 values of the targeting criteria were then predicted using the estimated coefficients and the 2008 values of the regressors (obtained through recall), or the 2004 values (if no recall data were available) as well as the household fixed effects. For voucher beneficiaries, the predicted 2009 values of their targeting criteria were each time corrected by subtracting the estimated effect of being a voucher beneficiary. The regression results are available from the authors upon request.

14. Note that only 26% of all households were considered eligible by the village for (at least) one voucher. Consequently, the theoretical value of the targeting differential T for the whole sample ranges between $[-0.52, 0.52]$ for all of the targeting criteria used here, except fertilizer use where the targeted population was 67% of all households as opposed to 50% for the other criteria. Given a standard deviation of 0.2, this suggests some villages are close to perfect targeting.

15. These statistics have been corrected for potential attrition bias using the inverse of the probability of being selected in round 3 (Footnote 6). While the share could also have been used as proxy, the number of households with an elected officials or VVC member that were eligible for a voucher and the total number of vouchers allocated in the village, which together define the share, are introduced separately in the regression, not to constrain their coefficients to be the same.

16. The degree of participation in meetings and associations was also considered as a proxy for awareness. It was not statistically significant in the regression analysis reported in Table 6 and given its correlation with the use of public media ($p = 0.26$) and the limited degrees of freedom, it was not retained.

17. There is also no relation between inequality and targeting performance when measuring within village inequality based on consumption as opposed to land.

18. This can be obtained by dividing the coefficients on the number of beneficiary households with elected officials by the coefficients on the number of vouchers beneficiaries (i.e. $-0.068/0.053 + 1 = -0.28$).

REFERENCES

Alderman, H. (2002). Do local officials know something we don't? Decentralization of targeted transfers in Albania. *Journal of Public Economics, 83*, 375–404.

Araujo, M. C., Ferreira, F., Lanjouw, P., & Ozler, B. (2008). Local inequality and project choice: Theory and evidence from Ecuador. *Journal of Public Economics, 92*, 1022–1046.

Baird, S., McIntosh, C., & Ozler, B. (2011). The regressive demands of demand-driven development. World Bank Policy Research Working Paper Series, 5883.
Banful, A. (2011). Old problems in the new solutions? Politically motivated allocation of program benefits and the "new" fertilizer subsidies. *World Development, 39*, 1166–1176.
Bardhan, P., & Mookherjee, D. (2000). Capture and governance at local and national levels. *American Economic Review, 90*, 135–139.
Bardhan, P., & Mookherjee, D. (2005). Decentralizing antipoverty program delivery in developing countries. *Journal of Public Economics, 89*, 675–704.
Bardhan, P., & Mookherjee, D. (2006). Pro-poor targeting and accountability of local governments in West Bengal. *Journal of Development Economics, 79*, 303–327.
Chavis, L. (2010). Decentralizing development: Allocating public goods via competition. *Journal of Development Economics, 93*, 264–274.
Christiaensen, L., & Sarris, A. (2007). Household vulnerability and insurance against commodity risks: Evidence from rural Tanzania. FAO Commodities and Trade Technical Paper No. 10. Rome: FMO.
Christiaensen, L., & Pan, L. (2010). Poverty evolution and the input voucher program in Kilimanjaro and Ruvuma, Tanzania 2004–2009. Report. Dar es Salaam: DFID Tanzania.
Coady, D., Grosh, M., & Hoddinott, J. (2004). *Targeting of transfers in developing countries: Review of lessons and experience*. Washington, DC: World Bank and International Food Policy Research Institute.
Dercon, S. (2006). Economic reform, growth and the poor: Evidence from rural Ethiopia. *Journal of Development Economics, 81*, 1–24.
Dercon, S., & Christiaensen, L. (2011). Consumption risk, technology adoption and poverty traps: Evidence from Ethiopia. *Journal of Development Economics, 96*, 159–173.
Dorward, A. (2009). Rethinking agricultural input subsidy programmes in developing countries. In A. Elbehri, & A. Sarris (Eds.), *Non-distorting farm support to enhance global food production*. Rome: FAO.
Faguet, J. (2004). Does decentralization increase government responsiveness to local needs? Evidence from Bolivia. *Journal of Public Economics, 88*, 867–893.
Galasso, E., & Ravallion, M. (2005). Decentralized targeting of an antipoverty program. *Journal of Public Economics, 89*, 705–727.
Grosh, M., del Ninno, C., Tesliuc, E., & Ouerghi, A. (2008). *For protection and promotion: The design and implementation of effective safety nets*. Washington, DC: World Bank.
Kelly, V., Crawford, E., & Ricker-Gilbert, J. (2011). The new generation of African fertilizer subsidies: Panacea or Pandora's box. USAID and Michigan State University Policy, Synthesis 87.
Johnson, S. R., & Rausser, G. C. (1971). Effects of misspecifications of log–linear functions when sample values are zero or negative. *American Journal of Agricultural Economics, 53*, 120–124.
Mansuri, G., & Rao, V. (2004). Community-based and -driven development: A critical review. *World Bank Research Observer, 19*, 1–39.
Morris, M., Kelly, V., Kopicki, R., & Byerlee, D. (2007). *Fertilizer use in African agriculture: Lessons learned and good practice guidelines*. Washington, DC: World Bank.
Park, A., & Wang, S. (2010). Community-based development and poverty alleviation: An evaluation of China's poor village investment program. *Journal of Public Economics, 94*, 790–799.
Platteau, J. (2004). Monitoring elite capture in community-driven development. *Development and Change, 35*, 223–246.
Seabright, P. (1996). Accountability and decentralization in government: An incomplete contracts model. *European Economic Review, 40*, 61–89.
Ravallion, M. (2000). Monitoring targeting performance when decentralized allocations to the poor are unobserved. *World Bank Economic Review, 14*, 331–345.
Ricker-Gilbert, J., Jayne, T. S., & Black, J. R. (2009). Does subsidizing fertilizer increase yields? Evidence from Malawi. Paper presented at 2009 AAEA annual meeting, July 26–28, Milwaukee, Wisconsin.
Ricker-Gilbert, J., Jayne, T., & Chirwa, E. (2010). Subsidies and crowding out: A double-hurdle model of fertilizer demand in Malawi. *American Journal of Agricultural Economics, 93*, 26–42.
Wiggins, S., & Brooks, J. (2010). The use of input subsidies in developing countries. Paper presented at the Global Forum on Agriculture, Paris.
Williamson, O. E. (2000). The new institutional economics: Taking stock, looking ahead". *Journal of Economic Literature, 38*, 595–613.
Wooldridge, J. (2002). *Econometric analysis of cross-section and panel data*. Cambridge: MIT Press.
World Bank. (2009). Accelerated food security program of the united republic of Tanzania under the global food crisis response program. Program description. World Bank Tanzania.

Table 8. *Estimated coefficients of the Cobb–Douglas production function*

	Log (maize and rice income + 1)	
	OLS	FE
Log (land owned +0.1) in ha	0.208***	0.207***
	(0.047)	(0.060)
Log (adult equivalent)	0.065	0.070
	(0.078)	(0.143)
Log (agr assets +1) in 1,000 Tsh	0.034*	0.008
	(0.019)	(0.034)
Log (livestock +1) in 1,000 Tsh	0.047**	0.059**
	(0.019)	(0.025)
Log (traditional seeds +1) in kg	0.170***	0.160***
	(0.030)	(0.037)
Log (improved seeds +1) in kg	0.200***	0.117**
	(0.038)	(0.049)
Log (organic fertilizer +1) in kg	−0.009	0.012
	(0.013)	(0.014)
Log (organic fertilizer +1) in kg % land irrigated*	0.032	−0.009
	(0.026)	(0.028)
Log (inorganic fertilizer +1) in kg	0.160***	0.107**
	(0.029)	(0.034)
Log (inorganic fertilizer +1) in kg % land irrigated*	0.060	0.132**
	(0.060)	(0.065)
Gender of household head	0.154	0.393**
	(0.106)	(0.186)
Education of household head	0.042**	0.016
	(0.013)	(0.023)
Percentage of illiterate household members	0.066	0.292
	(0.221)	(0.368)
Age of household head	−0.003	0.000
	(0.002)	(0.005)
Dependency ratio	−0.027	0.065
	(0.144)	(0.197)
Whether to plant maize	0.957***	0.904***
	(0.100)	(0.119)
Whether to plant rice	2.439***	1.308
	(0.365)	(0.822)
Whether to plant beans	0.275**	0.258**
	(0.092)	(0.102)
Whether to plant coffee	−0.368***	−0.548***
	(0.097)	(0.136)
Whether to plant banana	0.048	0.018
	(0.114)	(0.142)
Belong to SACCO	−0.040	0.030
	(0.116)	(0.138)
Has a bank account	0.125	−0.060
	(0.117)	(0.154)
Constant	0.524	1.035**
	(0.352)	(0.452)
Time-varying village dummies included		
R-squared	0.502	0.413
F-statistic	23.104	12.955
No. of Obs.	2,618	2,296

Note: All variables in value are divided by a price index to convert to be in 2003 price.
* Denotes significance at 10% level.
** Denotes significance at 5% level.
*** Denotes significance at 1% level.

APPENDIX A. ESTIMATING THE MARGINAL PRODUCTIVITY OF INPUT

Standard Cobb–Douglas production functions are estimated here based on the data from all three survey rounds. This permits estimation of the marginal productivities of fertilizers and seeds. The specification includes the standard input variables: land, labor, capital, traditional and modern seeds and organic and inorganic fertilizers. As the effectiveness of fertilizer use is affected by the timely supply of water, they are further interacted with the percent of land irrigated. Household demographics and education level, land quality, crop portfolio, and access to credit were further added as controls affecting total factor productivity:

$$\begin{aligned}\ln(I_{vht}) = {} & \alpha_{Lan}\ln(Lan_{vht}+0.1)+\alpha_{AE}\ln(AE_{vht})\\ & +\alpha_{AA}\ln(AA_{vht}+1)+\alpha_{Liv}\ln(Liv_{vht}+1)\alpha_{TS}\ln(TS_{vht}+1)\\ & +\alpha_{IS}\ln(IS_{vht}+1)+\alpha_{OF}\ln(OF_{vht}+1)\\ & +\alpha_{OFI}LI_{vht}\ln(OF_{vht}+1)+\alpha_{IF}\ln(IF_{vht}+1)\\ & +\alpha_{IFI}LI_{vht}\ln(IF_{vht}+1)+\alpha_{h}H_{vht}+\alpha_{M}M_{vht}+\varepsilon_{vh}, \qquad \text{(A1)}\end{aligned}$$

where *I, Lan, AE, AA, Liv, TS, IS, OF, LI, IF* denote total income from maize and rice (in 2003 prices), land, adult equivalents, agricultural assets, livestock, traditional seeds, improved seeds, organic fertilizer, percentage of irrigated land, and inorganic fertilizer, respectively. The variable H is a set of household characteristics and M is a set of time-varying village dummies, which also help control for temporal and spatial price changes. Eq. (A1) is estimated both using OLS and OLS with household fixed effects to mitigate further against omitted variable bias from unobserved household heterogeneity, with $\ln(\widehat{I}_{vht})$ the predicted value of maize and rice income for household h in village v at time t based on the estimated coefficients $\hat{\alpha}$ and the household value of the regressors at t. A small constant (= 1) is added to the input variables to enable inclusion of observations with zero values (Dercon, 2006; Johnson & Rausser, 1971). These are very small values compared to the average value of the input variables, and thus unlikely to induce any bias. For land, however, only 0.1 is added, because 1 is close to the mean of the variable (see also Johnson & Rausser, 1971).

Land, agricultural assets, and livestock have a significant positive effect on maize and rice production (in 2003 prices) and male headed and better educated households are increasing overall output, in line with the literature (Table 8). The estimated coefficients on improved seeds and inorganic fertilizer (the key variables of interest here) are also positive and significant, with irrigation further increasing the effect of fertilizer. Similar results were obtained (not reported here) when considering total crop income instead of maize and rice only.

Given the specification in double logs, the estimated coefficients on the input variables reflect elasticities (i.e. the percentage increase in maize and rice income (in 2003 prices) given a percentage increase in input use). Using the estimated coefficients of the household fixed effect regressions in Table 8, the marginal effects of improved seeds ($\frac{\partial I_{vht}}{\partial IS_{vht}}$) and inorganic fertilizer ($\frac{\partial I_{vht}}{\partial IF_{vht}}$) on maize and rice income are then calculated as:

$$\begin{aligned}\frac{\partial I_{vht}}{\partial IS_{vht}} &= \hat{\alpha}_{IS} * \frac{\exp(\ln \widehat{I}_{vht})}{IS_{vht}+1} \qquad \frac{\partial I_{vht}}{\partial IF_{vht}}\\ &= (\hat{\alpha}_{IF}+\hat{\alpha}_{IFI}LI_{vht}) * \frac{\exp(\ln \widehat{I}_{vht})}{IF_{vht}+1} \qquad \text{(A2)}\end{aligned}$$

From (A2) it can be seen that a household's marginal productivity increases in its predicted maize/rice income, while it decreases in current input use. Non-users are thus more likely to display a higher marginal productivity, though not necessarily so, as the marginal productivity also depends on their current (predicted) output (and thus household characteristics such as land ownership, education, membership of financial institutions, etc.). Furthermore, without adding a small constant, the marginal productivity for non-input users would not be de-

Table 9. *Targeting performance using predicted targeting indicator values*

Targeting indicators	$\overline{T}$ (1)	$\overline{T}_{intra}$ (2)	$\overline{T}_{inter}$ (3)	T_v (4)
Targeting by poverty				
FEI poverty line[a]	−0.055	−0.027	−0.028	−0.021
				(0.205)
Targeting by efficiency				
High marginal prod. seeds	0.049	0.050	−0.000	0.061
				(0.232)
High marginal prod. fertilizer	0.001	0.003	−0.002	0.004
				(0.195)
Targeting by poverty and efficiency				
High marginal prod. seeds and poor (FEI)	−0.025	0.000	−0.025	0.011
				(0.226)
High marginal prod. fertilizer and poor (FEI)	−0.035	−0.008	−0.027	−0.128
				(0.253)
Targeting by past use				
Past nonusers of improved seed	−0.117	−0.084	−0.033	−0.099
				(0.220)
Past nonusers of fertilizer	−0.152	−0.054	−0.099	−0.097
				(0.28)

Note: The targeting indicators are predicted 2009 values (see Table 4 and Footnote 13 for details). For column (4), means of the variables per village are reported. Standard deviations are reported in the brackets.

[a] FEI poverty line (Christiaensen & Pan, 2010).

fined, while adding a very small constant (e.g. 0.1) would artificially inflate their marginal productivity. It is, however, hard to imagine that the marginal productivity of a household that uses 1 kg of fertilizer is very different from the marginal productivity of a household that uses no fertilizer (the recommended amount is about 150–200 kg per ha). Note furthermore that for the purposes of this study, it is only the ranking of households that matters and not the level of marginal productivity as such. The Spearman rank correlation coefficients between the marginal productivity adding a constant of 0.5 and 2 and the marginal productivities obtained adding a constant of 1 are indeed very high (between 0.97 and 0.99), indicating that the ranking of the estimated marginal productivities results is robust to the use of alternative constants. Adding the constants 0.5 or 2 instead of 1, does not affect the results in Tables 3 and 6 either (results are available upon request). When adding 0.1, the Spearman rank correlation is lower, reflecting the artificial inflation, but still quite high (0.75).

APPENDIX B

See Table 9.