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Cross-sector insights into the challenges of targeting and crowding-out in agricultural and health voucher subsidy schemes: an economic analysis

Thesis submitted for the degree of PhD
2015

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Abstract

In recent years there has been a renewal of interest in subsidising agricultural inputs and public health products to achieve various social, economic and public health objectives. Despite numerous justifications, implementers face a range of practical challenges that can significantly undermine the achievement of policy or programme goals. At the centre of these challenges lie the issues of targeting and how to maximise incremental increases in ownership and use of the products being subsidised, over the short and longer-term.

This thesis adopts a cross-sector approach to the identification of its research questions and methodological approaches, drawing on both the agricultural and health literatures, exploring the potential for cross-sector learning. The empirical research is based around Malawi's Farm Input Subsidy Programme (FISP) and the Tanzania National Voucher Scheme (TNVS) for mosquito nets. Concentration curves and concentration indices, as used in the health literature, are adapted to estimate the socioeconomic-related inequality at key stages in the transmission of fertiliser subsidies to farmers in the FISP, complemented by a qualitative investigation of the key determinants of outcomes at these stages using semi-structured interviews. The impact of the TNVS on demand for unsubsidised mosquito net purchases is then explored using non-linear multivariate regression to estimate a household demand model, as applied in the agricultural input subsidy literature.

Overall, the results highlight the numerous challenges associated with targeting agricultural and health subsidy programmes and subsequent implications. In particular, the analysis on the FISP urges caution in the use of community-based targeting in certain contexts, while that on the TNVS encourages greater investigation of what more can be done to ensure that subsidies lead to higher incremental increases in ownership and use of the products being subsidised. As a whole, the thesis demonstrates the utility of a cross-sector approach to research.

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Acronyms and abbreviations

ACT	Artemisinin-based combination therapy
ADMARC	Agricultural Development and Marketing Corporation
AIS	Agricultural input subsidy
AISP	Agricultural input subsidy programme
AISS	Agricultural Input Subsidy Survey
AMF-m	Affordable medicines facility-Malaria
AME	Average Marginal Effect
ANC	Antenatal care
CBT	Community-based targeting
CC	Concentration curve
CI	Concentration index
DH	Double Hurdle
EPA	Extension Planning Area
FGD	Focus group discussion
FISP	Farm Input Subsidy Programme
FISS	Farm Input Subsidy Survey
ITN	Insecticide-treated mosquito net
IV	Instrumental variable
LLIN	Long-lasting insecticide-treated mosquito net
LMIC	Low- or middle-income country
MC	Marginal cost
MCA	Multiple Correspondence Analysis
MFC	Marginal factor cost
MoAFS	Ministry of Agriculture and Food Security
MR	Marginal revenue
MWK	Malawian kwacha
MVP	Marginal value of production
NATNETS	National Insecticide Treated Nets Programme
NB	Negative Binomial
OLS	Ordinary Least Squares
ORT	Oral rehydration therapy
PHP	Public health product
PHPS	Public health product subsidy
SAL	Structural adjustment loan
SSA	Sub-Saharan Africa
TNVS	Tanzania National Voucher Scheme
TZS	Tanzanian shilling
VDC	Village Development Committee
WTP	Willingness to pay

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1 Introduction

1.1 Background

Since the turn of the millennium there has been a substantial growth in the number of programmes and policies in low- and middle-income countries (LMICs), which aim to reduce the price paid for specific commodities deemed important for agricultural production or public health. A key driver behind this trend has been the desire of governments and, particularly in the case of health, the international community, to substantially increase the level of use of such products in order to meet a wide range of policy objectives. In agriculture these include increasing national and household food production, improving household income and strengthening input supply markets. In health they include a range of public health objectives such as reducing malaria-related deaths, transmission of sexually transmitted infections and malnutrition as well as strengthening private sector supply of affordable health products. While the programmes and policies differ in various ways within and across the sectors, some have come to occupy a central position in the attempts by governments to tackle socioeconomic and health challenges, despite requiring significant financial, administrative and institutional resources. It is partly for these reasons, as well as the existence of a number of considerable challenges in achieving their full potential impacts, that these initiatives have stirred a number of burgeoning debates and criticisms.

To date, research into these programmes and policies has taken a single sector focus, looking at particular issues either from an agricultural or health perspective. This reflects the general tendency within academia and beyond to compartmentalise our knowledge and understanding into sectoral ‘silos’ (Waage et al., 2010). While there is obviously a need to develop specialised knowledge within sectors, given that the subsidy initiatives mentioned above share a number of common features in their design, broad conceptual justification, and challenges in their implementation, there may be important lessons and insights to be learnt by looking at both literatures and particular issues together. This may be broadly defined as taking a cross-sector research approach. Some potential benefits of this approach are considered in Table 1.

Table 1: Benefits of a cross-sector approach to research

Benefit	Explanation
<i>Development of new research questions</i>	Entrenched research traditions, ideologies or policy priorities may prevent certain research questions from being considered or from being given the attention they deserve. Exposure to thinking in another sector may help to stimulate new ideas for future research. For example, where policy priorities for particular outcomes mean that certain issues are overlooked but may actually be critical to the effective functioning of the policy in question.
<i>Strengthening analysis or providing new policy insights through cross-fertilisation of methods</i>	The way in which impacts and outcomes are studied and measured may differ across sectors, even within the same broad discipline. This may arise because of tendencies or norms among researchers in a given sector, meaning that useful methods go unused or underutilised. In this case, the adaptation and application of methods used in another sector to answer similar questions may help extend and deepen existing empirical analysis.
<i>Encouraging the questioning and development of theory</i>	Analysing how particular policies are thought about and conceptualised in another sector may help to promote a critical re-thinking of dominant paradigms or existing conceptual frameworks. Drawing on the evidence and experience from more than one sector may help provide the basis for a stronger theoretical framework with which to understand and research particular policies or approaches.
<i>Practical operational lessons to overcome challenges or improve cost-effectiveness</i>	Where sufficient similarities exist between policies in two or more sectors, research around specific programmatic or policy approaches used in one sector could be considered for application in the other. These approaches may include the use of certain programme design features, technologies, or approaches to implementation.

Source: Author.

This thesis seeks to investigate what insights can be gained by comparing and contrasting the experiences of subsidy policies and programmes in agriculture and health and empirically investigating two issues of crucial importance within both sectors. The first issue concerns targeting outcomes and the determinants of those outcomes. Who ends up receiving subsidies and how much is received can fundamentally determine the success of a subsidy initiative in terms of how far it raises incremental coverage or use of the product being subsidised. This in turn has implications for its impacts, including on final outcomes such as health or food security and the socioeconomic distribution of increases in household income, as well as for cost-effectiveness. The second issue is the extent to which subsidies on particular products crowd-in or crowd-out purchases of equivalent unsubsidised products. That is, how far they lead to further future unsubsidised purchases or displace unsubsidised purchases respectively. The level of crowding-out in turn determines the impact a subsidy initiative has on raising incremental coverage of the particular product being subsidised and therefore its cost-effectiveness. The issues of targeting and crowding-in /-out are inter-linked in that the level of crowding-out will

crucially depend on who receives the subsidy. For example, if the recipient were someone who would have purchased the product at full price anyway the subsidy leads them to forego that purchase, this would be a case of crowding-out. By contrast, if the recipient would not have purchased the product but in receiving a subsidised version is encouraged or becomes able to purchase future unsubsidised equivalent products, this represents a case of crowding-in.

Both issues are discussed in more detail in the following chapter, where it is shown how both topics demonstrate particular scope for cross-sector learning. In the case of targeting, a review of the literature reveals how methods used in the health sector to investigate the socioeconomic-related inequality in targeting outcomes could be usefully applied to measuring targeting outcomes of agricultural subsidies. Regarding crowding-in and crowding-out, the particular concern shown for these issues in the agricultural sector inspires a closer look in the case of a health subsidy policy where there has so far been more limited empirical research.

In summary, the overall research aim of the thesis is:

To investigate the theoretical, methodological, empirical and policy insights that can be gained in relation to voucher subsidies in agriculture and health through drawing on the literature and experience of both sectors, specifically relating to the issues of socioeconomic inequality in targeting and the challenge of crowding-out.

The specific research objectives that guide the empirical research are presented following the literature review, at the end of chapter 3.

1.2 Definitions

Before giving an overview of the broad methodology adopted in this paper, it is important to define more specifically the two types of subsidy being investigated. Both share the basic feature of reducing the private cost of specific products, used either in agricultural production or to improve public health outcomes. The emphasis in this thesis is on these subsidies within a LMIC context.

Typical definitions of the term ‘subsidy’ are often problematic. Many tend to focus on the subsidy being funded by a particular entity (usually a government) and often to the benefit of a particular beneficiary (usually an enterprise or industry) and for specific purposes. For example, one standard dictionary definition refers to a subsidy as ‘A sum

of money granted from public funds to help an industry or business keep the price of a commodity or service low' (OUP, 2001). By contrast, other dictionary definitions can end up so broad as to lose the distinct meaning of a subsidy. For example, 'A grant or contribution of money' (OUP, 2001) could in theory include donations. Given these limitations, the term subsidy is defined here by the author as:

a grant (or a loan if it is to be repaid at below the market price after interest) passed on to an individual, company, or organisation by any actor with the aim of reducing the private cost to the grantee for a good or service.

In defining the specific types of subsidy being considered in this thesis, it is helpful to situate them within a broader range of subsidy policies. Table 2 presents a typology of explicit subsidies, which are those specifically aimed to reduce the price of a good or service. These stand in contrast to implicit subsidies, which reduce the cost of a good or service indirectly (e.g. through a favourable exchange rate) but where the subsidy may not necessarily be the primary or sole intention of the associated policy.¹ In Table 2 the object of the subsidy is shown within each cell according to delivery mechanism (horizontal) and the broad category of subsidy (vertical).

A few comments on Table 2 are helpful. Firstly, a distinction can be made between full and partial subsidies, with the former implying a 100% subsidy whereby the recipient is expected to pay nothing. A partial subsidy, by contrast, requires the beneficiary to pay some contribution towards the total price of the good or service being subsidised. Secondly, a distinction can be made relating to delivery mechanism between 'indirect subsidies' and 'direct subsidies'. The former are those received in a form that is physically separate to the eventual goods or services being subsidised, generally through a voucher, while 'direct subsidies' are obtained by recipients directly at the point of sale. Where this is associated with the subsidy being available to all individuals or all within a particular subsector (e.g. smallholder farmers), the term universal subsidy may then be appropriate to describe it. It is also important to note that while Table 2 distinguishes between subsidies according to the delivery mechanism, it says nothing about who finances the subsidy, which may often be the government, though can also include a range of other actors.

¹ This distinction is taken from (Pinstrup-Andersen, 1993).

Table 2: A typology of subsidy policies in agriculture and health

Category of subsidy	<i>General infrastructure</i>	<i>Specific infrastructure</i>	<i>Knowledge services</i>	<i>Public health products / agricultural inputs</i>	<i>Other products</i>
Delivery mechanism					
<i>Vouchers</i>	N/A	N/A	Sexual and reproductive healthcare, technical training	Mosquito nets, fertiliser, seeds	Food, fuel
<i>Social marketing</i>	N/A	N/A	Sexual and reproductive healthcare, handwashing	Contraceptives, oral rehydration therapy, mosquito nets, malaria treatment, water purification	Fortified food
<i>Direct partial price subsidy (government, NGO, private or mix)</i>	Water and sanitation	Irrigation or energy	User-fee based healthcare	Malaria treatment, fertiliser, seeds, farming equipment	Food, fuel
<i>Free distribution or investments (government, NGO or public-private partnership)</i>	Investment in roads, energy	Investment in irrigation or healthcare infrastructure	Healthcare services, agricultural extension services	Mosquito nets, seeds, farming tools, contraceptives	Food
<i>Price controls</i>	N/A	N/A	N/A	Government guaranteed price for staple crops, medicine	Food, fuel

Source: Author. N/A indicates that there are few examples of subsidies within the category by a particular delivery mechanism.

From Table 2 it can be seen that subsidies on public health products and agricultural inputs are one category that concern the subsidisation of specific types of physical product. These products may however be quite different, for example, in their frequency of purchase, whether they are consumable or durable and in their value. This may have important implications for the design of a subsidy programme, the potential role of a subsidy in stimulating future purchases, the incentives for corruption and leakage and for how impacts are evaluated, among others.

Turning now to the definitions of agricultural input subsidies (AISs) and public health product subsidies (PHPSs), in the literature AISs have been defined somewhat more broadly than in Table 2. For example, Tiba has suggested that input subsidies can be defined as ‘any kind of public investment which promotes input use...including provision

of agricultural research, extension services, irrigation pumps, etc.’ (Tiba, 2010: 1). Fan et al. (2007) consider input subsidies as covering direct support to input industries and across fertiliser, credit, irrigation and power. However, for the purpose of this thesis, a more narrow definition is used, defining AISs as:

a grant (or loan, if repaid at below the market price after any interest) given to a farmer as a means of reducing the private cost of a specific input used in agricultural production.

Inputs here refer to products used on the farm such as fertiliser, seeds, storage chemicals and durable goods such as farming tools and equipment. Unlike other definitions, the emphasis here is on goods and not services. The reason for this is to ensure the review and analysis remain focused, but also because goods and services are conceptually quite different, which can have implications for analysis and interpretation.

Turning to the health sector, while there is a definition for public health products, there appear to be few attempts to define PHP subsidies. PHPs have been defined as ‘commodities that are used for treatment of diseases of public health importance or for the promotion of health, which can be provided at the retail level without a “service” attached to them’ (Conteh and Hanson, 2003: 1148). Examples include condoms and insecticide-treated mosquito nets (ITNs). PHPs are therefore defined here as:

a grant (or loan, if repaid at below the market price after any interest) given to an individual as a means of reducing the private cost of a specific public health product.

It should be noted that, in contrast to the existing definitions of general subsidies given above, neither definition for AISs or PHPs are specific about who finances the subsidy, nor about the specific delivery mechanism. The reason for this is that, as will be seen in the subsequent section, in practice there have been a number of different combinations of programme design. As noted above, in both definitions the focus is on those goods that can in theory be sold without the need for a service to be attached, meaning that such goods may be sold through a variety of delivery mechanisms such as through public, private, or other non-governmental providers. However, while there may be no need for a service to be attached, unlike with certain products such as vaccinations, it will generally be to the benefit of subsidy programmes in both agriculture and health to provide guidance on the appropriate use of the products. This has implications for complementary policies, including support and regulation of the private sector if it is used to deliver subsidised goods.

1.3 Overview of methods and case selection

In order to investigate targeting and crowding-out, two policy case studies were chosen, one in agriculture and one in health. Malawi's Farm Input Subsidy Programme (FISP) was selected for the former and the Tanzanian National Voucher Scheme (TNVS) for mosquito nets for the health example. Both cases were found to have specific gaps in their related empirical literature and also benefitted from the availability of sufficiently large datasets containing the required data in order to carry out the necessary analysis.

Overall, the thesis adopts a mixed-methods approach. In the case of the FISP, concentration curves and concentration indices are estimated with repeated nationally representative household survey data to estimate the degree of socioeconomic-related inequality associated with a range of targeting outcomes over the lifetime of the programme. Fieldwork was then carried out in Malawi to collect semi-structured interviews from a range of stakeholders involved in the FISP in order to explain the findings from the quantitative analysis.

The analysis on the TNVS is entirely quantitative, with the exception of two in-depth interviews carried out with key stakeholders involved at a high operational level in Tanzania to help inform the analysis. The quantitative analysis involved the econometric estimation of a household demand model for unsubsidised mosquito nets, using a range of non-linear multivariate regression techniques. The inclusion of subsidised net purchases as the key explanatory variable allows for estimates of the effect that past purchases of partially subsidised mosquito nets had on future unsubsidised net purchases.

1.4 Structure of the thesis

The next chapter reviews the changing theory, thinking and practice of AISs and PHPSs and synthesises some key similarities and differences between the sectors. Chapter 3 then reviews the specific literature on the issues of targeting and crowding-in and crowding-out. Chapters 4 to 6 are three paper-style empirical chapters, which include their own literature review, methods and discussion. Chapter 7 draws together the findings from these three empirical chapters and reflects on the overall contribution of the thesis.

2 The shifting theory, thinking and practice of agricultural input subsidies and public health product subsidies

2.1 Introduction

This chapter begins to bridge the gap between the literatures on AISs and PHPSs by reviewing the shifting theory, thinking and practice of both types of subsidy and synthesising key similarities and differences between the sectors. The review draws particularly on literature gathered through a systematic search of CAB Abstracts and Medline - two major academic databases of relevance to the agricultural and health literatures respectively. Search strings were carefully constructed and tested in order to cover the range of relevant literature.² Articles then went through two stages of screening in order to identify studies that focused in particular on the impacts of AISs or PHPSs in LMICs. The search helped cover the wide breadth of historical literature that exists across both sectors, including the history of theory and practice, the various design and implementation issues, key debates, as well as the strength of evidence around various impacts, which ultimately assisted in the identification of the topics that form the basis of the empirical analysis in the thesis. Grey literature was also captured through additional online searches and recommendations from supervisors Professor Andrew Dorward and Dr Catherine Goodman.

The first two sections of this chapter put AISs and PHPSs into their historical context, exploring trends in thinking and practice within each sector up to the present day. A number of the current debates, issues and questions from the field as a whole are reviewed. The third section then provides a brief synthesis of the two literatures by pulling out some of the key similarities and differences relating to impacts and challenges in particular.

First of all, however, it is useful to highlight some key differences between the agriculture and health sectors in LMICs in order to provide a basis for understanding the differences between AISs and PHPSs. Table 3 focuses on three key issues, from which a number of important distinctions arise. First, while the health sector is concerned primarily with maintaining the health of a population, the agricultural sector both provides a source of income (at the household level and nationally) and also helps ensure that people have access to a sufficient and diverse diet (either through the market or own production), which in turn is central to leading a healthy life. Second, whereas in health there is a far

² Search strings can be found in Appendix 1.

greater acceptance of the primary and extensive role played by the government (especially for protecting the poorest and most vulnerable), in agriculture the appropriate role of the state has for some time largely been seen as more circumscribed towards making certain basic investments and providing a more limited range of services. However, these views are changing slightly in both sectors. For example, in agriculture there has been a renewal in recent years of the idea that the government may have a temporary role to play in facilitating access to agricultural inputs where the market would otherwise under-provide them. In health, there is now a greater acceptance of the role the private sector can and should play in helping to increase access to and coverage of certain PHPs. These key differences are useful to bear in mind while considering the different experiences of AISs and PHPs, not least in terms of the greater acceptance within the health sector of subsidising certain products.

Table 3: Key differences between the agriculture and health sectors in LMICs

	Agriculture	Health
Basic functions / objectives of the sector	Source of income and livelihood for individuals, households and the wider economy. Source of food, nutrition, sustenance and therefore basic health of individuals and households.	Source of services and products to meet the health needs of individuals and to maintain public health.
Dominant view regarding appropriate role of government	Government responsible for investments in basic infrastructure (public goods) that would likely be under-provided if left to the market (e.g. roads, research and extension services). More recently, some renewal of the idea that market failures may justify temporary subsidised government provision of specific inputs necessary for increasing agricultural production (e.g. fertiliser and improved seeds) if targeted to those who would not otherwise use such inputs.	Government responsible for provision of all basic health services, particularly ensuring that the poorest and most remote are not left without access. Key justification for the special government role in access to services and goods is due to extensive market failures in health care provision.
Dominant view regarding appropriate role of private sector	Countries should be moving towards a situation where the private sector is responsible for providing access to inputs on a commercial basis.	An appropriately regulated formal private sector can help support and complement the public sector in improving and maintaining public health, particularly through the sale of public health products.

Sources: Agriculture: (Dorward et al., 2004, Morris et al., 2007, World Bank, 2007). Health: (Hanson, 2004, Hsiao and Heller, 2007, Mills et al., 2002, Patouillard et al., 2007, Söderlund et al., 2003).

2.2 Agricultural input subsidies: an historical overview

2.2.1 Early input subsidies in theory and practice

AISs were a prominent feature in the agricultural policy of many LMICs in the post-independence period, which is somewhat unsurprising when one considers what Kherallah et al. (2002) refer to as the ‘ideological footprint’ left by departing colonial powers, who themselves often intervened fairly extensively within colonial economies. AISs generally took the form of large-scale, direct, universal subsidies available either to all farmers or those of a particular type, through government control over prices, often using public distribution channels (Islam, 1980, Niaz, 1984, Wallace, 1986). Loans were also often extended from international donors, such as the United States, World Bank and Asian Development Bank (Gaud, 1968, Wallace, 1986). While fertiliser was often the main focus, governments also subsidised other inputs, such as high-yielding seeds, pesticides and farm machinery (Asuming-Brempong, 1994, Repetto, 1985). Particularly in parts of Asia and Latin America, input subsidies were also often part of a wider package of governmental support, which included investment in rural infrastructure, irrigation, research and extension, credit and high-yielding seeds (Chaturvedi et al., 1982, Fan et al., 2007, Gangadharan and Kumbhare, 1982, Johnson et al., 2003). It was this combination of policies that has been credited with underpinning the substantial improvements in yields and agricultural productivity from the late 1960s, particularly in Asia, referred to as the Green Revolution (Gaud, 1968).

The general aims of subsidy programmes varied, though they were often linked to increasing self-sufficiency in staple crops through raising yields and, particularly in the case of many Asian economies, encouraging the production of new high-yielding varieties, which required fertiliser and irrigation (Barker and Hayami, 1976, Islam, 1980). Other policy aims included compensation of farmers due to loss of output and income due to export taxes and price controls (Quibria, 1987), and supporting rural incomes for reasons of equity and industrial policy (Committee on Controls and Subsidies, 1979).

The level of subsidy provided to farmers varied quite widely, though according to the 1986 World Development Report, fertiliser subsidies in the early 1980s were ‘rarely below 30 percent of delivered cost and were in some cases 80 to 90 percent (in Nigeria, for example). Rates of 50 to 70 percent [were] common’ (World Bank, 1986: 95). The volume of inputs permitted to be subsidised and the cost to government often ended up being substantial. Of seven Asian countries covered by a study in the late 1980s, the fertiliser subsidy as a percentage of current government expenditure ranged from 0.32 in

Afghanistan to 6.56 in Bangladesh in 1981/82, and from 2.51 in Bangladesh to 5.99 in Nepal in 1984/85 (Quibria, 1987). The importance attached to these subsidies by farmers generally led to considerable political pressure for subsidy rates to increase or at least for subsidies to not be removed in the face of increasing fertiliser prices, therefore representing a significant challenge for governments in avoiding growing inefficiencies (Gulati and Narayanan, 2003).

Within the research and policy community, at least until the mid-1980s a number of researchers acknowledged that, under certain circumstances, AISs could be justified by bringing about a positive net benefit to social welfare (Ahmed, 1978, Barker and Hayami, 1976, Timmer, 1985). The main theoretical justification arose from the recognition that, while subsidies may lead to welfare losses in economies that are in competitive equilibrium, agricultural economies were often not in equilibrium due to sub-optimal input use (Quibria, 1987, Timmer, 1985). At the time this was thought to arise because farmers were unclear about the optimal level of fertiliser use, lacked knowledge about the benefits of inputs, were risk averse and / or suffered from credit constraints (Barker and Hayami, 1976, Timmer, 1985, Tower and Christiansen, 1988).

Theoretically, a subsidy on fertiliser was seen as justified providing there was a large gap between the actual and optimum levels of input use, where the optimal level is where the Marginal Value of Production (MVP) is equal to the Marginal Factor Cost (MFC) (Barker and Hayami, 1976).³ That is, where the marginal cost (MC) of applying an extra unit of input equals the marginal benefit gained from the resulting extra unit of output. For Timmer, a fertiliser subsidy was worth using if the Marginal Revenue (MR) from the change in fertiliser use induced by a subsidy was greater than its full MC, including social costs ‘*plus* the share of incremental output incurred as costs of harvesting, marketing and processing’ (Timmer, 1985: 58).

It should be noted, however, that in spite of the generally supportive policy environment, from at least the late 1970s AISs were also considered by some economists as ‘second-best’ options, with other investments such as improvements in physical and institutional infrastructure like irrigation, research extension systems, education or credit markets seen as often more effective at achieving self-sufficiency in the long-run, though less attractive for politicians and policy makers given large investments and long gestation periods (Barker and Hayami, 1976, Tower and Christiansen, 1988, World Bank, 1986). The idea

³ While the term Marginal Cost is used by Barker and Hayami, the term MFC, as used by Dorward, is considered a more appropriate definition in this context (Dorward, 2009).

of input subsidies representing a second best option has been referred to as the Barker-Hayami thesis (Sambrani, 1982).⁴

Looking in more detail at the theoretical operation of AISs, and continuing with the example of fertiliser subsidies, these were seen to work by a lower price of fertiliser lowering the MC curve facing farmers. Faced with lower MCs, standard neoclassical theory suggests this will shift the equilibrium point at which $MC = MR$ and thereby encourage increased use of inputs, according to the price elasticity of demand for fertiliser held by farmers. Over time, the increased use of inputs should lead to a rightward shift in the supply curve of the crop to which the fertiliser is applied according to the production elasticity of fertiliser and specific agro-ecological conditions, in turn helping to raise net social welfare (Barker and Hayami, 1976, Tower and Christiansen, 1988).

Drawing on Barker and Hayami (1976), these effects can be seen by looking first at the demand for fertiliser in the presence of a subsidy in Figure 1, where DD and SS are the domestic demand and supply curves for fertiliser respectively and S_w is the world supply, which is assumed perfectly elastic. X_0 is the quantity demanded at the unsubsidised world price (P_{fw}), which shifts to X_s following the imposition of a fertiliser subsidy at price P_{fs} . The area $ABP_{fs}P_{fw}$ then represents the core government cost of the fertiliser subsidy (excluding any administrative or other costs).

To understand the theoretical benefits of such a subsidy, Figure 2 represents the domestic supply and demand of a particular staple crop in the presence of a fertiliser subsidy. P_e is the domestic equilibrium price of the crop prior to any subsidies or imports and $P_d = P_w$ is the world price of the crop, which is assumed equal to a target price by the government in order to maintain consumption at the level Q_c (P_w' and P_w'' simply represent fluctuations to a higher and lower world price respectively). DD represents the total demand for the crop. SS represents the initial domestic supply, which we assume is restricted due to sub-optimal use of fertiliser.

⁴ Tower and Christiaensen (1988) did note that AISs may be preferable if the resource costs of longer term investments exceed the inefficiencies associated with AISs.

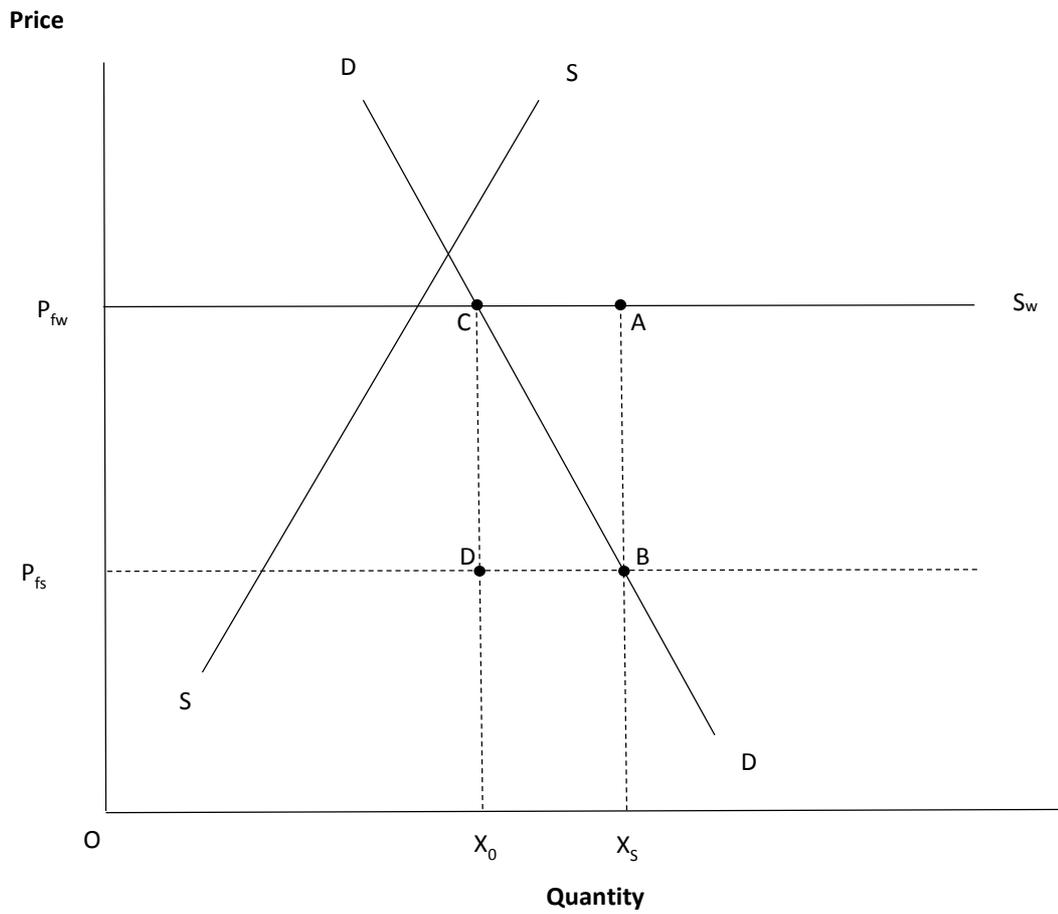


Figure 1: Demand for fertiliser in the presence of a subsidy
Source: Adapted from Barker and Hayami (1976)

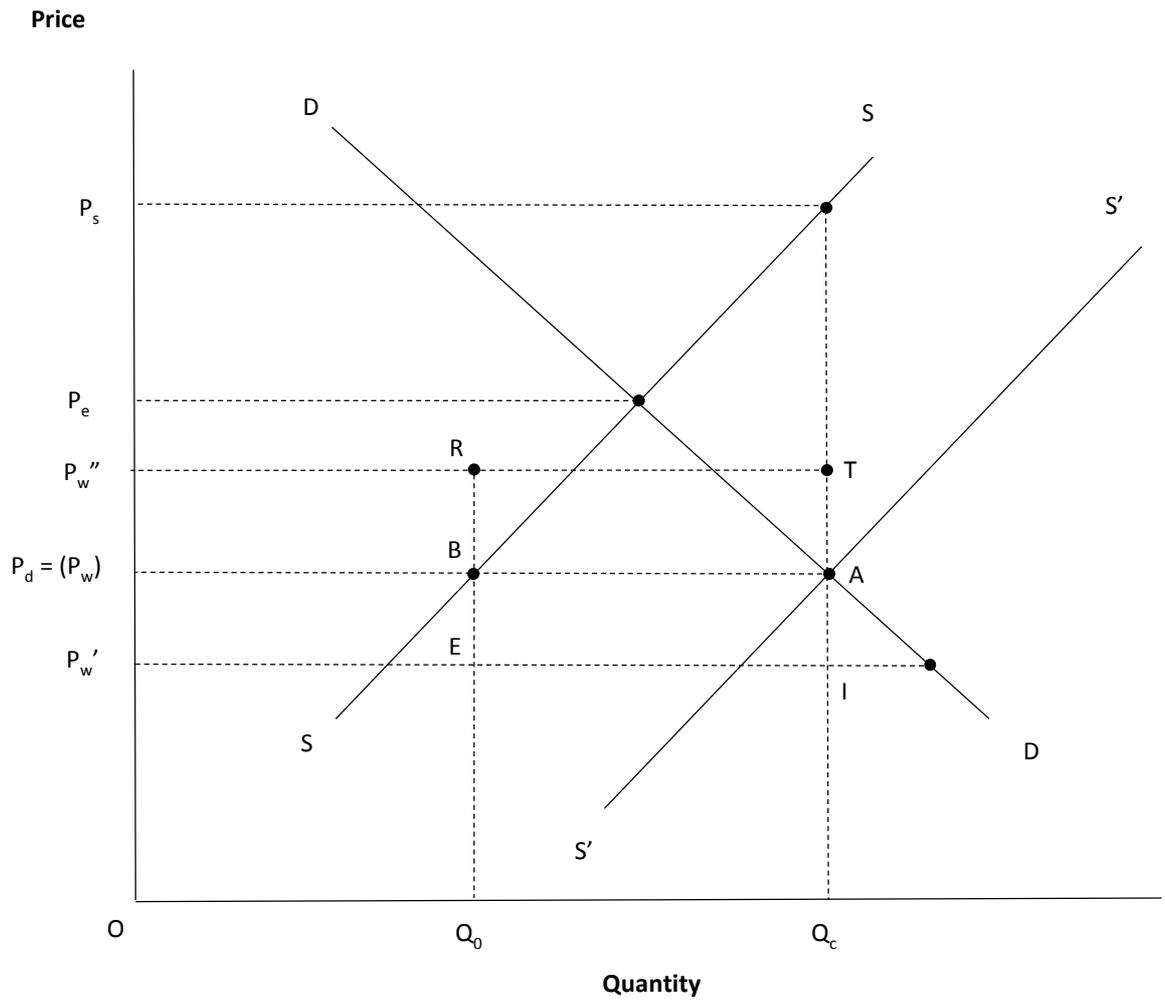


Figure 2: Impacts of a fertiliser subsidy on staple crop production
Source: Adapted from Barker and Hayami (1976)

If, as in Figure 2, the prevailing world price (P_w) is below the domestic equilibrium price (P_e) then the country may be expected to import the quantity AB in order to meet domestic food requirements / demand at this lower price. However, depending on the world price such a policy may be an expensive one for maintaining food security. One alternative to maintain consumption at Q_c is to subsidise the price of fertiliser sufficiently to shift domestic production out to $S'S'$. The rightward shift in the supply of the staple crop was seen to depend crucially upon: the price elasticity of demand for the subsidised input; the MVP/MC ratio; and the yield response from increased use of the input (Barker and Hayami, 1976, Timmer, 1985).

The following potential welfare impacts then arise. Firstly, depending on the relative cost of fertiliser compared to the imported staple crop, the government may benefit (lose) from an increase (decrease) in revenue arising from a reduction in staple imports. For example, if the world price of the crop was relatively high (P_w'' in Figure 2) then, providing the cost of subsidising the amount of fertiliser required to meet self-sufficiency was sufficiently low, the government might increase its revenue by forgoing the cost of the expensive staple imports needed to meet domestic demand, represented by $ABRT$.

Secondly, there may be net savings in foreign exchange arising from the net reduction in expenditure on the imported staple (ABQ_0Q_c in Figure 2) minus any increase in foreign exchange required for the additional fertiliser imports due to the subsidy (ACX_0X_s in Figure 1).

Thirdly, domestic producers of the staple crop were seen to gain from a fertiliser subsidy both through the lower cost of fertiliser (represented by $ABP_{fs}P_{fw}$ in Figure 1) as well as the increased output value (ABQ_0Q_c from Figure 2) minus the cost of purchasing the additional fertiliser (BDX_0X_s in Figure 1) and other incremental production costs.

In this particular model, consumer welfare was not seen to change at all as the baseline scenario involved the same level of consumption at the same price, maintained by importing the amount AB (Figure 2). However, where some form of export controls are in place or high transport costs drive a wedge between import and export prices, a sufficient supply response to a fertiliser subsidy would likely lead to the consumer price of the staple crop decreasing, which could be a source of a variety of considerable indirect welfare effects, with an obvious initial cost to net producers (Dorward, 2009).

In theory, AISs were generally seen to provide a positive economic surplus to producers at the expense of a net welfare loss to the government, with consumers assumed to experience a more negligible effect compared to producers. However, a number of other

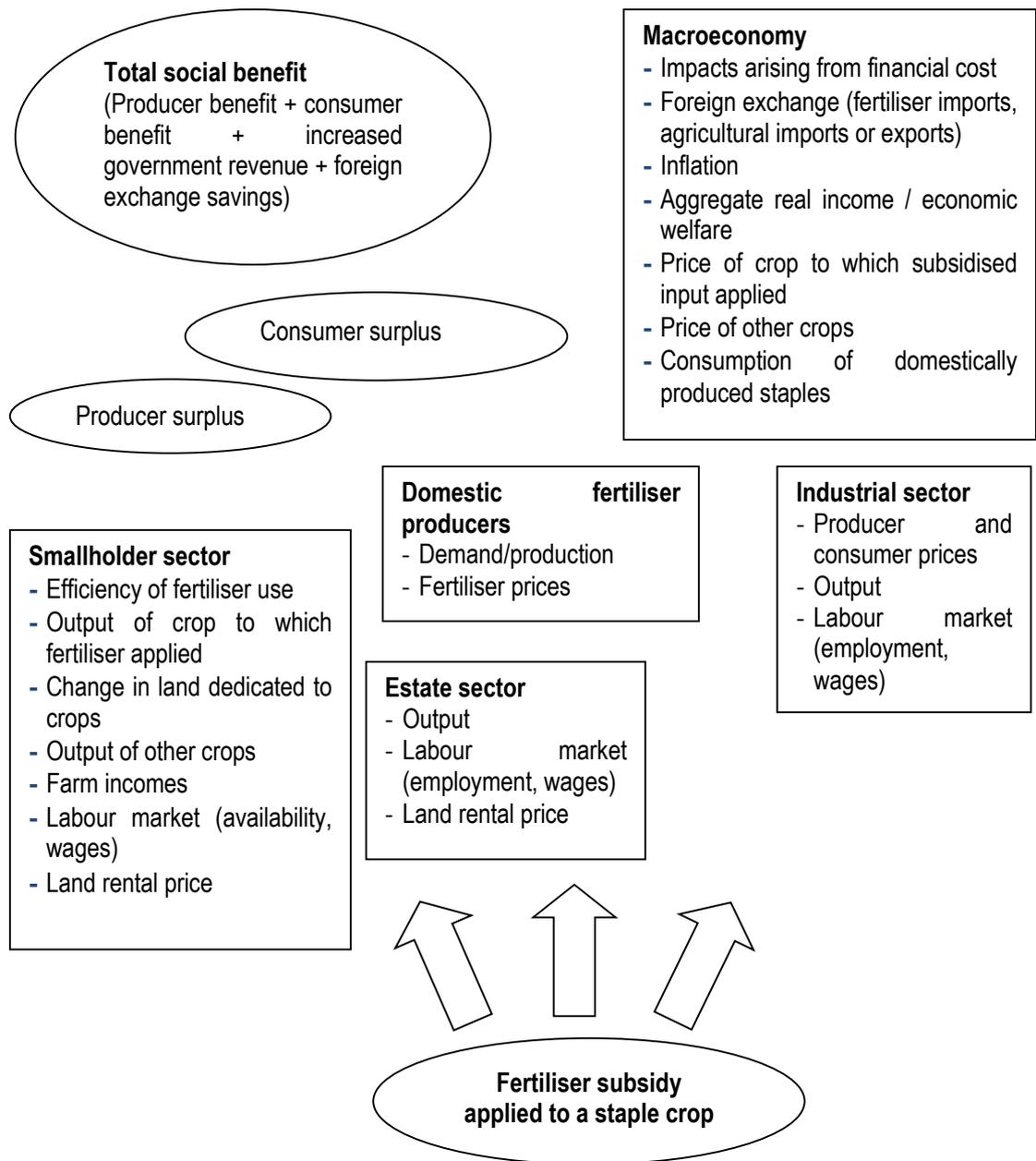
possible wider impacts were also noted in the literature, particularly within partial and general equilibrium frameworks. These are drawn together in Figure 3.

2.2.2 Changes in thinking and practice during structural adjustment

Increasingly from the mid-1980s there was growing concern and criticism relating to the use of AISs, accompanied by a considerable scaling down in their use particularly in sub-Saharan Africa (SSA), primarily through conditions attached to structural adjustment loans (SALs) that were extended to increasingly indebted countries.⁵ A number of reasons seem to explain this shift. Firstly, within the research and policy community there was growing criticism relating to the justifications for subsidies and the awareness that subsidies had often outlived their short-term role, becoming an inefficient drain on government resources, with negative impacts such as encouraging overuse of inputs and displacing government funds for necessary physical and institutional infrastructure that was seen to yield higher returns and an improved distribution of income (Gulati and Narayanan, 2003, Martinez, 1989, Quizon, 1985, World Bank, 1986). Some more supportive views did still exist, such as that by Quibria (1987) who recognised that ‘...there is no unique answer regarding the desirability of subsidies for all countries at all stages of economic development’, though views such as these became increasingly marginalised. By 1990, the mainstream critique had become more hardline. In one particularly critical report by the World Bank, input subsidies were considered to be market distorting, inefficient, an increasing strain on government finances, and ultimately non-beneficial to the smallholder sector (Knudsen and Nash, 1990). A further argument put forward was that fertiliser subsidies did nothing to address the supply side constraints, which were increasingly seen to be the major problem holding back low fertiliser use (Donovan, 1996).

⁵ In some cases the use of input subsidies did continue despite considerable external pressure (e.g. India, Indonesia and Nigeria).

Figure 3: Summary of the main impacts of fertiliser subsidies in the early literature



Sources: Author's conception adapted from (Barker and Hayami, 1976, Quizon, 1985, Tower and Christiansen, 1988).

Secondly, specific criticism of AISs appears to have come at a time during which there was a fundamental shift within mainstream economics, away from the dominance of earlier Keynesian thinking towards a more free market approach based on microeconomic foundations. This was epitomised by the rise of rational expectations and new classical macroeconomics from the 1970s. These shifts represented a move towards emphasising the perfect operation of markets based on optimisation by rational agents and full market clearing (Snowdon and Vane, 1997). With this shift came growing scepticism about the role of government intervention within the economy.

Thirdly, the mid-1980s also saw a major shift in policies among key international donors such as the World Bank, away from earlier support for government intervention towards 'pricist and state minimalist policies' (Lipton, 1987), which taken together were subsequently coined the Washington Consensus (Williamson, 1989). In this view, and mirroring the dominant economic thinking of the time, considerable emphasis was placed on addressing supply-side constraints, moving away from an earlier emphasis within economics on the importance of the demand-side (Keynes, 2007, Rosenstein-Rodan, 1943).

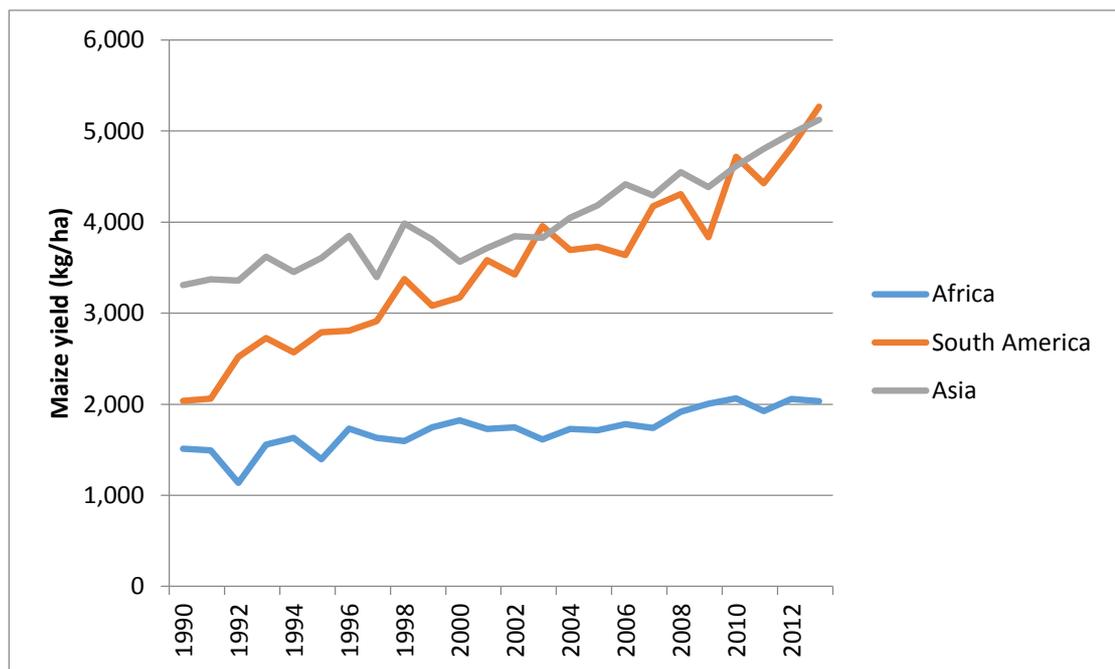
Finally, the continued economic fragility of many newly independent countries led to a growing indebtedness and dependence on international financial institutions such as the World Bank and IMF, which needed to contain their own fiscal outlays and attached a range of conditions to their SALs. The 1980s and 1990s therefore saw the scaling-down and wholesale removal of AISs in many LMICs as part of the conditions attached to SALs (Kherallah et al., 2002). One review in 1996 found that 16 out of 29 African countries had reduced or eliminated their fertiliser subsidy programmes (Donovan, 1996).

2.2.3 Recent changes in thinking and practice

By the late 1990s it had become increasingly apparent that the removal of input subsidies had not generally been replaced by flourishing private sector input industries selling affordable inputs, hence the tendency towards lower fertiliser use (Osorio et al., 2011, Quizon, 1985). One exception often referred to is Kenya, which has seen an increase in fertiliser use in recent decades, though it is recognised to contrast with the general experience within SSA and therefore of many LMICs (Ariga and Jayne, 2009). As SALs often involved removal of other policies that were also important for farmers in accessing inputs, such as credit schemes, it is unsurprising that the removal of input subsidies was associated with a significant decrease in the affordability of fertiliser or profitability of

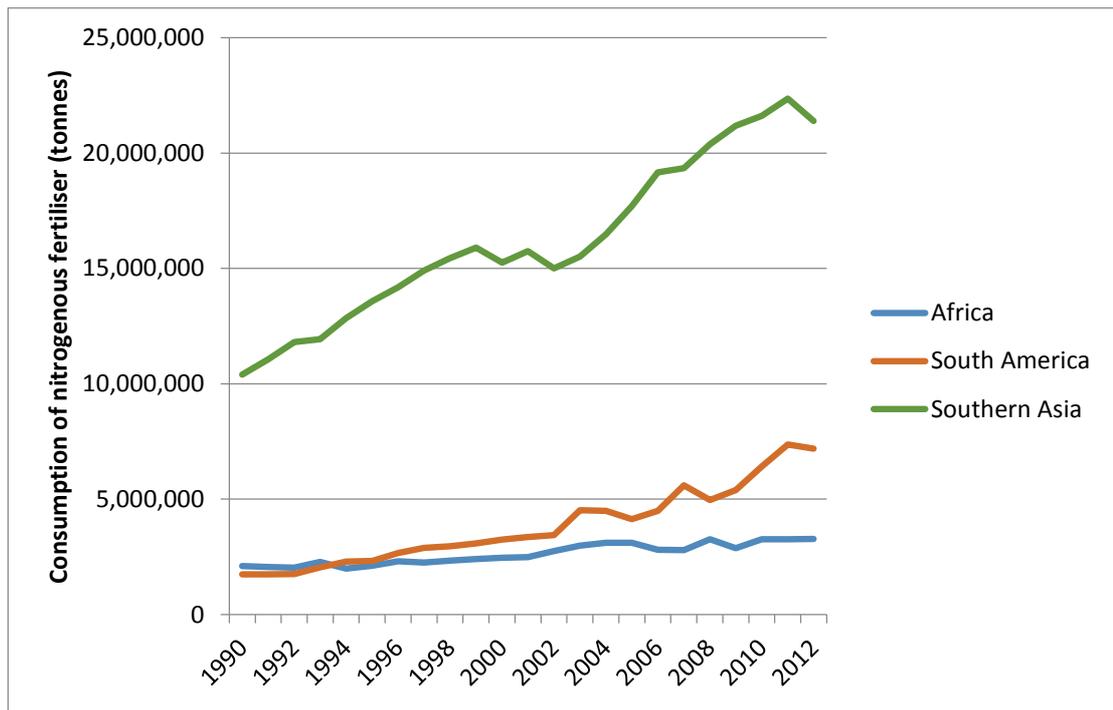
staple production, leading to declining returns to farmers, shifting production patterns and various negative externalities (Asuming-Brempong, 1994, Harrigan, 2008, Holden, 1996). While some are more sceptical about associating the reduction or removal of subsidies with changes in fertiliser use (Donovan, 1996), across many LMICs, particularly in SSA, countries were clearly suffering from agricultural decline and widespread food insecurity (Reardon et al., 1997, Yanggen et al., 1998). In Africa, yields of maize – a key staple crop within the continent – have remained fairly stagnant in the past few decades in comparison with other regions containing LMICs (Figure 4). While there are various reasons for this poor performance, one of the key issues is the stagnation in levels of fertiliser use. Figure 5 demonstrates this, plotting the consumption of nitrogenous fertiliser in Africa against that in Latin America and southern Asia.

Figure 4: Stagnating maize yields in Africa (1990 to 2013)



Source: FAOSTAT.

Figure 5: Stagnating consumption of nitrogenous fertiliser in Africa (1990 to 2012)



Source: FAOSTAT.

Aside from the practical realities of persistently low fertiliser use and low staple production, there has also been a shift away from the dominance of the earlier economic thinking that underpinned the Washington Consensus policies, with a move towards an alternative position from the late 1990s described as the post Washington consensus. This new paradigm emphasised, among other things, the importance of state action to invest in human capital, with a greater focus on addressing poverty and on targeted social safety nets (Stiglitz, 1998). New Institutional Economics was also gaining traction, highlighting the crucial importance of the state and institutions in achieving capitalist development and the realities of widespread market failure and high transaction costs in LMICs (Dorward et al., 2004, Dorward et al., 1998, North, 1990).

Within policy circles it was becoming apparent that while privatisation and liberalisation of fertiliser markets may have been important, it was far from sufficient for breaking the high-price-low-demand cycle, which would require a focus on the fundamental problems of high transaction costs, risks and widespread poverty (Yanggen et al., 1998). The solution, according to some, was to encourage a strong increase in demand for fertiliser at the same time as improving market efficiency (Yanggen et al., 1998).

Over recent years there has been a growing political consensus, again within SSA in particular, of the need to dramatically increase fertiliser use, including through the use of targeted subsidies as demonstrated in the Abuja Declaration (African Union, 2006). It was against this backdrop along with continued widespread poverty and looming food crises, and more recently the 2007/08 global spike in food prices, that a number of new government input subsidy initiatives have therefore emerged since the end of the 1990s, particularly in SSA. One of the early pioneers was Malawi with its Starter Pack programme in 1998, which aimed to distribute enough free fertiliser and seed for all smallholder farmers to be able to cultivate 0.1 hectares of staple crops (Levy, 2005). By 2009, Dorward identified 10 AISP in SSA alone, with many more reported there and in other regions by the International Fertiliser Development Center (Dorward, 2009).⁶ Further programmes were reported a few years later (Chirwa and Dorward, 2013a, Jayne and Rashid, 2013).

In contrast to earlier AISs, most of the new programmes now take somewhat different approaches. This includes experimenting with vouchers to better target and deliver subsidies and greater involvement of the private sector in the distribution and sale of subsidised inputs (Chirwa and Dorward, 2013a). There have also been some universal subsidy programmes, though there is somewhat tighter rationing of inputs compared to earlier AIS programmes (Jayne and Rashid, 2013). However, many of the programmes continue to represent sizeable proportions of the public agricultural budgets, which is one of the reasons why they have come under such considerable scrutiny (Jayne and Rashid, 2013). For example, the cost of Malawi's Farm Input Subsidy Programme averaged just over 7% of the national budget between 2006/07 and 2011/12, excluding 2008/09 when a spike in the price of fertiliser led to it representing 16% (Chirwa and Dorward, 2013a).

Programmes have varied quite widely in terms of their scale, with some more localised or pilot projects and others far bigger national programmes. Levels of subsidy per beneficiary also vary widely, with some offering a rationed package of inputs that are fully subsidised and others subsidising from 50% or more of the full cost of inputs (Chirwa and Dorward, 2013a, Dorward, 2009: 35).

It was only really after a number of countries began to implement AISPs that there was a major mainstream re-think in the theory behind AISs with the emergence of the 'market smart' paradigm (Morris et al., 2007). While remaining sceptical of the use of subsidies on economic grounds, this perspective acknowledges that temporary targeted subsidies

⁶ Three of those in SSA were part of the evolving policy in Malawi beginning with the Starter Pack.

on fertiliser, when used as part of a broader package of policies, can be justified on a number of grounds. They may play a role in overcoming specific market failures such as absent financial or insurance markets (Donovan, 2004, IFDC, 2003), they could help to kick-start input supply industries through stimulating demand and helping to achieve economies of scale (Morris et al., 2007), or even correct negative environmental externalities associated with soil fertility depletion (Donovan, 2004, Gladwin et al., 2002). Morris et al. (2007) therefore argue that fertiliser subsidies may support longer-term agricultural productivity growth provided they adhere to a number of principles. These are set out in full in Appendix 2. According to the authors:

‘Market-smart subsidies are temporary interventions that work singly or in combination to lower the price and/or improve the availability of fertilizer at the farm level in ways that encourage efficient use of fertilizer while at the same time promoting private investment in fertilizer markets. The main differences between traditional fertilizer subsidies and market-smart fertilizer subsidies are that market-smart fertilizer subsidies are temporary, they do not distort the relative price of fertilizer relative to other inputs so as to encourage excessive and economically inefficient use of fertilizer, and they are designed to shift incentives faced by buyers and sellers in ways that are consistent with the development of sustainable private markets for fertilizer.’

(Morris et al., 2007: 103)

As can be seen from this quote, in contrast to fears within the earlier mainstream view of subsidies undermining input markets, a key argument behind the market smart paradigm is that AISs may actually be an important policy for helping to stimulate the very demand needed in order to establish private input supply markets. This represents a notable u-turn from the earlier emphasis within the mainstream critique on the importance of focusing on supply-side measures.

A key part of the market smart approach is ensuring effective targeting of subsidies, with vouchers considered to be an important design tool in this regard. A number of theoretical benefits and disadvantages of vouchers have been put forward (Minot and Benson, 2009, Morris et al., 2007: 107-108). Potential benefits include:

- Being able to build demand for inputs and accelerate input market development, providing those targeted do not already use the inputs;

- Facilitating graduation away from subsidies, such as by reducing the value of vouchers over time; and
- Facilitating targeting of specific farmers.

Potential weaknesses or disadvantages include:

- High administrative costs in design and implementation, especially given the need for measures to control corruption and rent-seeking;
- Danger of leakage and corruption if vouchers can be resold, which will likely undermine programme objectives; and
- The need for recipients to have access to an input supplier.

Although the mainstream position now acknowledges some role for fertiliser subsidies under specific conditions, it also puts forward a large number of arguments against using subsidies, with Morris et al. (2007), referring to no less than 10 (see Figure 6). However, closer inspection of these suggests that most arguments are not arguments against subsidies *per se*, but rather challenges which must be recognised and addressed through careful programme design and implementation.

Figure 6: Arguments against AISs according to the market smart perspective

‘Arguments against fertiliser subsidies’
<ul style="list-style-type: none"> • High fiscal cost which makes them fiscally unsustainable • Crowding out of private sector • Rent seeking • Regressive distribution of benefits • High administrative costs • Late delivery • Inefficiency at the farm level • Leakages to neighbouring countries • Creation of vested political interests • Lack of complementary measures

Source: (Morris et al., 2007).

A further perspective that considers AISs in a more positive light is the position of Jeffrey Sachs and some others, which, rather than emphasising the role of AISs in supporting the development of the private sector, focuses on how large-scale AISs can be a means of helping smallholder farmers overcome ‘poverty traps’ (Morris et al., 2007: 8). With the emphasis on poverty reduction, this perspective also has a somewhat different view on targeting, with it being suggested that AISs should be targeted at highly food insecure farmers (UN Millennium Project, 2005). However, as with the market smart approach, it is also aware of the utility of using some form of vouchers for targeting and of seeing subsidies as a relatively short-term or temporary policy.

A further view, sharing some similarities with both the market smart perspective and the poverty trap perspective is that taken by Dorward (2009). While recognising the importance of a number of market smart principles, such as targeting those who would otherwise not have purchased inputs, Dorward puts forward alternative justifications for AISs; being able to address profitability and affordability / cash constraints. A further key difference in this view is the recognition of the much wider range of economic benefits that may arise from input subsidies, depending on how they are implemented, including:

- A long term ‘thickening’ of supply chains and rural markets;
- Lower staple food prices and higher wages;
- Increased real incomes for poor non-recipients as a result of food price and wage changes; and
- Longer term structural changes in livelihoods and the rural and national economy with expanded domestic demand for higher value livestock and horticultural products and for non-farm goods and services together with expanded supply capacity, due to release of land and labour as a result of increased staple crop productivity (Dorward, 2009).

The conceptual framework in Figure 7 highlights these potential impacts along with a range of mediating contextual factors.

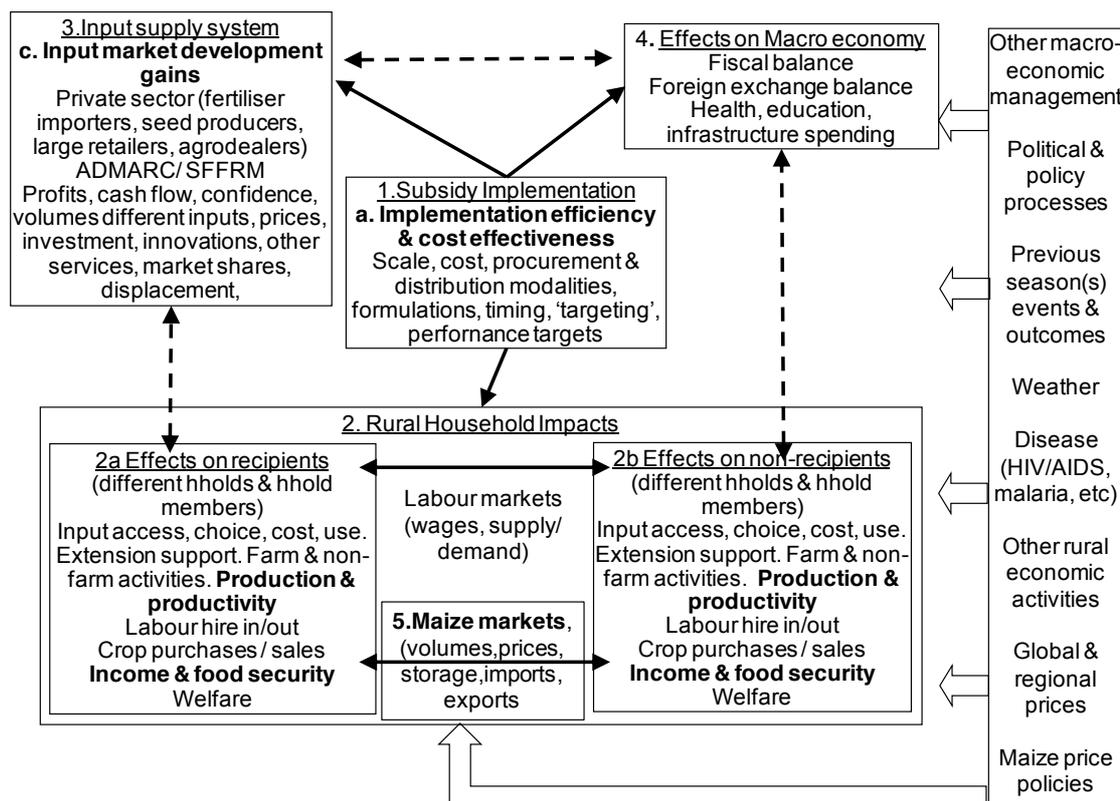


Figure 7: Conceptual framework of the impacts of AISs

Source: (SOAS et al., 2008)

Acknowledgement of potential wider benefits does not mean that Dorward believes these benefits are always obtained or that major problems do not exist. Rather, the view is simply less dismissive of the potential for AISs to work and to play a central part in the process of agricultural and economic transformation in certain LMICs, if implemented appropriately.

In terms of the evidence regarding the impacts of recent AISs, there is a wide and growing literature covering a whole manner of effects, which cannot all be covered here. However, a summary of some of the key contemporary issues, debates and challenges along with relevant evidence is provided in Appendix 3.

In brief, while the pendulum has somewhat swung back in favour of AISs being a legitimate policy tool, there remain considerable debates over when they might be justified, how they should be implemented and their actual impacts. This is confounded by a lack of data and monitoring and evaluation in many programmes (Dorward, 2009: 32).

2.3 Public health product subsidies: an historical overview

2.3.1 Early practice and thinking behind public health product subsidies

As with AISs, the use of PHPs is not a recent phenomenon. Among the earliest examples found in the literature search were those associated with social marketing programmes for contraceptives from the 1960s onwards (Black and Harvey, 1976, Boone et al., 1985: 31, Chandy et al., 1965). The term social marketing is attributed to Kotler and Zaltman, who have described it as ‘the design, implementation, and control of programs calculated to influence the acceptability of social ideas and involving considerations of product planning, pricing, communication, distribution, and marketing research’ (Kotler and Zaltman, 1971: 5). In other words, it involves the use of marketing skills and subsidisation of PHPs in order to make them attractive for the purpose of achieving social change. The aims of early social marketing programmes were generally to popularise the use of modern PHPs deemed to be of importance to public health, and to provide a reliable source of affordable supply (Boone et al., 1985: 30).

In the case of the early contraceptive social marketing programmes, PHPs were generally made available at prices that were ‘only a fraction of those charged for products of similar quality in the private commercial sector’ (Boone et al., 1985: 30-31). For example, the Nirodh Marketing Programme in India, which eventually operated at a national scale, involved the government being responsible for covering the costs of the marketing campaign and condoms, which were subsequently distributed through the private sector, allowing retailers to sell them at 80% below market value (Gupta, 1970).

Given the emphasis on the use of commercial channels, many programmes involved the private sector and/or non-profit organisations - Population Services International - being a key example - though also with a role for public institutions such as ministries of health. As other PHPs were deemed important from a public health perspective they too were distributed using social marketing methods. For example, by the end of the 1970s Oral Rehydration Therapy (ORT) was being recommended as a key healthcare intervention, leading to a number of related subsidy initiatives (Fox, 1988, Kenya et al., 1990: 979).

In general, many programmes appear to have been fairly large-scale, though accessibility would have depended crucially upon the distribution networks established. There also does not appear to have been much targeting or rationing, other than through the decisions on where products were made available.

While theoretical economic foundations of PHPSs appear to have been much less developed than for AISs, part of the underlying justification for using social marketing techniques was ‘the growing conviction that traditional public health measures were inadequate to achieve broad popularity and acceptance of modern social and health programs’ (Boone et al., 1985: 30). In other words, the public health care networks were recognised as being too limited to achieve the desired levels of uptake and coverage.

With the accumulation of practical experience, in the 1980s a number of papers emerged involving some theoretical reflections upon the experiences of social marketing from higher income countries. For example, in the early 1980s Bloom and Novelli (1981) raised a number of challenges that social marketing programmes can face, covering topics such as marketing analysis, market segmentation, pricing, communications and evaluation. Later on in the decade, Lefebvre and Flora (1988) highlighted eight essential aspects to ensure cost-effective social marketing programmes based on experiences from the United States. This included: advice around use of a consumer orientation in the development and marketing of intervention techniques to develop and market intervention techniques (as opposed to a producer or sales orientation that is typical in business); the use of audience analysis and segmentation strategies for intervention design; and use of the marketing mix (product, price, place and promotion).

2.3.2 Growing challenges and criticisms arising in the 1980s and 1990s

As mentioned earlier, from the 1980s many LMICs were facing growing budget deficits and economic crises. With increasingly limited financial resources, there were growing criticisms relating to inefficient use of resources in the health sector (Mills, 1998). Following this, there were calls from the World Bank for countries to introduce user fees for health care as a way of meeting increasing demands (Akin et al., 1987).

From the beginning of the 1990s, some concerns were also being raised regarding the impact that subsidised products may have had on commercial provision of the same products (Hanson et al., 2001). Some questioning of the market impacts of PHPSs was emerging out of a broader paradigmatic shift in healthcare across the globe, towards the principles of ‘New Public Management’, the general aim of which was to increase the efficiency of public services primarily through the use of market mechanisms (Mills, 1998: 506).

While the changing economic environment and critical questioning of PHPSs does share some parallels with the rise of the mainstream critique in agriculture, it does not appear to have led to the same widespread backlash against and removal of PHPSs as occurred in the agricultural sector. There continued to be various examples of PHPS programmes taking place throughout the 1980s and 1990s (Fox, 1988, Janowitz et al., 1992, Kenya et al., 1990). These were generally social marketing programmes, often for contraceptives, and other previously subsidised commodities such as ORT. At least part of the reason for this is likely to be that subsidies for the PHPSs in question would have not been anywhere near as costly as subsidies on fertiliser, which were reported earlier to have represented a considerable portion of government revenue in some countries.

2.3.3 Recent changes in thinking and practice

As the 1990s were drawing to a close, and particularly since the early 2000s, there has been a rapid growth in the number of PHPS programmes taking place in LMICs with a number of new arguments put forward in their favour. A review of rigorous PHPS impact studies by the author found, from 1996, six ITN programmes in Africa, a number of country programmes associated with the global Affordable Medicines Facility-malaria (AMF-m) programme for artemisinin-based combination therapies for malaria (ACTs), and examples of contraceptive social marketing programmes and subsidies on nutritional supplements and ORT. Key features of these programmes are summarised in Table 4.

A number of reasons seem to explain these developments. Firstly, while there continue to be examples of subsidising conventional PHPSs, there has been a notable growth in the subsidisation of other products following trials on their effectiveness. This is particularly true for ITNs, as well as ACTs (Schellenberg et al., 1999, Wang et al., 2011, Yeung et al., 2011).

Secondly, there has been much international focus on the setting of ambitious targets for health as well as other social, economic, and political goals. This manifested itself in 2000 with the Millennium Development Goals declaration and also in the 2000 Abuja Declaration, which committed LMICs and the global community to achieve a target of at least 60% coverage of those at risk and suffering from malaria through access to preventative measures such as ITNs and effective and timely treatment (UNGA, 2000, WHO, 2000).

Thirdly, as part of this process there has been a notable growth in the size and influence of international civil society groups, including Population Services International, the Bill and Melinda Gates Foundation and the Global Fund to Fight AIDS Tuberculosis and Malaria. These groups have all been influential in financing and supporting various public health initiatives, including PHPSs.

In terms of their design and implementation, there have been a number of innovations in recent PHPSs. Regarding targeting, while there are still examples of universal targeting (e.g. the AMF-m initiative, which provides a direct price subsidy at the point of sale) there has been some shift towards a greater focus on targeting subsidies in a way that will help to bring about the maximum public health benefit with the given resources (World Bank, 2005). Another part of this is the strong emphasis in health of addressing inequalities in access as it can often be the poorest who tend to benefit least (Magadi et al., 2003, Worrall et al., 2005).

In terms of targeting mechanisms, one of the major innovations concerns the increasing role played by the private sector in the delivery of subsidised PHPs and the associated growth of indirect subsidies through the use of vouchers, which can be used as part payment for PHPs at private or public outlets (World Bank, 2005). However, there continue to be a wide range of delivery mechanisms, including free public distribution (e.g. for ITNs, condoms, and ACTs). The increasing role of the private sector emerges from the recognition that it has become a key source of health care products and services in many LMICs (Patouillard et al., 2007). However, some authors are somewhat less supportive of the benefits of using the private sector as a means of distributing subsidised PHPs, highlighting a number of negative outcomes arising from it in the context of the AMF-m, such as diversion of subsidised products benefitting third parties, and poor targeting arising from incentives to made profits (Bate and Tren, 2011, Marriott, 2009). Marriott also argues that financial resources may be better spent investing in an improved public health care system.

Table 4: Summary of selected PHS programmes and key design features

Programme country / Product	Tanzania's Kilombero Net Project (KINET)	Tanzanian Voucher Scheme (TNVS)	Ghana ITN voucher scheme	Ghana national ITN scheme	Kenya PSI coverage plus ITNs (LLINs from 2005)	Zambia social marketing of ITNs
Start year	ITNs 1997	ITNs (LLINs from 2009) 2004	ITNs 2004	ITNs 2005	ITNs (LLINs from 2005) 2002	ITNs 1998
Beneficiary and criteria for mechanism for beneficiary selection	No restrictions on socially marketed sales but vouchers for higher subsidy given to pregnant women and mothers of young children on attending antenatal clinic	Pregnant women on attending antenatal care clinics and mothers of infants attending their measles vaccination	Pregnant women on attending antenatal care clinics	Pregnant women on attending antenatal care clinics	Social marketing in all malaria-endemic districts. From 2004 a higher subsidy provided to women attending maternal and child health clinics.	No restrictions in sales
Transmission of subsidy to selected beneficiaries	Social marketing: beneficiaries buy from a mixture of public and private sales outlets. Vouchers: redeemed at same outlets.	Voucher: beneficiaries given voucher that they redeem for a net at an authorised private sector outlet	Voucher: beneficiaries given voucher that they redeem for an ITN at an authorised private sector outlet	Direct subsidy: women could buy direct from clinic. Voucher: could opt for voucher to purchase from private retailer.	Social marketing: through retail sector. Direct subsidy: through maternal and child health clinics.	Social marketing: purchase through rural health centres
Level of subsidy (per unit)	25%-30% subsidy on cost of ITNs and 90% on retreatment kits. Vouchers provided an additional 17% subsidy on ITNs.	Approximately 70% of retail price	US\$ 2.20 discount on the retail price	50% of retail price	Socially marketed price US\$1.30 (rural) or US\$4.70 (urban). Maternal and child health clinic price for LLINs (from 2005) US\$0.70	Sale price US\$ 2.50. 91% of estimated commercial prices.
Scale (area)	Kilombero and Ulanga districts	National from May 2006	Volta and Eastern Regions	Lawra District (national over time)	National	3 districts in Eastern Province (mainly rural)
References	(Abdulla et al., 2001, Hanson et al., 2003, Kikumbih et al., 2005, Schellenberg et al., 2001)	(Hanson et al., 2009; Marchant et al., 2010, Njau et al., 2009)	(Webster et al., 2010)	(Grabowsky et al., 2007)	(Noor et al., 2007)	(Agha et al., 2007)

Source: Author's summary. Note that programmes are subject to change over time. For exchange rates refer to individual studies.

Programme country	Tanzania (pre-AMFm pilot#1)	Tanzania (pre-AMFm pilot#2)	Kenya ACT pilot	Cameroon Jeune marketing	100% social marketing	Uganda social marketing 'Clear Seven'	Burundi social marketing of ORASEL	Nepal scale-up of Zinc promotion
Product	ACTs	ACTs	ACTs	Contraceptives	Contraceptives	Contraceptives and antibiotics	ORT	Zinc supplements
Start year	2007	2007	2008	2000	2000	1999	2004	2007
Beneficiary criteria	No explicit targeting	Only targeting at public health facilities for children under 5 and pregnant women	Children (3-59 months)	15-24-year-olds living in Yaoundé and Douala	15-24-year-olds living in Yaoundé and Douala	No explicit targeting	Caregivers of children under 5	Caregivers of children under 6
Mechanism for beneficiary and selection and transmission of subsidy	Point of sale, primarily small pharmaceutical shops	Public health facilities and point of sale at private government-accredited drug dispensing outlets	Point of sale at retail outlets (ACT packages designed for child doses)	Social marketing through condom outlets	Social marketing through condom outlets	Point of sale at private health care outlets	Social marketing: at pharmacies and retail outlets	Social marketing: through pharmacies, health posts, private clinics, hospitals, & community health workers
Scale (area)	2 rural districts	Health facilities: national. Private outlets: 10 districts in Ruvuma and Morogoro regions.	3 districts in Western Province	Focus on 2 largest cities (Yaoundé and Douala)	Focus on 2 largest cities (Yaoundé and Douala)	3 rural districts and two divisions of the capital	National by Oct 2006	From 3 to 30 districts (out of 75) between 2007 and 2008
Level of subsidy (per unit)	ACTs sold to wholesaler 88% below price offered to public sector. Actual highest price paid 81% below typical retail price	Health facilities: 100% for under-5s and pregnant women or US\$0.25 for others. Private outlets: suggested price US\$0.40 (children's dose), US\$1.30 (adult dose).	Retailers instructed to provide 96% subsidy on usual retail price	Unknown.	Unknown.	Unknown. Sold to outlets at manufacturing cost and recommended for sale at US \$0.72	Unknown. Product sold for around US\$ 0.05	Unknown.
References	(Cohen et al., 2010, Sabot et al., 2009)	(Alba et al., 2010, Rutta et al., 2011)	(Kangwana et al., 2011)	(Meekers et al., 2005, Plautz and Meekers, 2007)	(Meekers et al., 2003)	(Jacobs et al., 2003)	(Kassegne et al., 2011)	(Wang et al., 2011)

Source: Author's summary. Note that programmes are subject to change over time. For exchange rates refer to individual studies.

The growing use of vouchers emerges in part out of the desire to target specific groups of individuals. It also emerges from a growing awareness of the need to address demand generation. The idea underpinning this is set out in the notion of demand side financing (Gupta et al., 2010). For example, there has been the suggestion that vouchers might help bring commercial supply out to remote rural areas (Roll Back Malaria, 2005). Other theoretical benefits of vouchers put forward include them interfering less with the supply-side and allowing holders to have a choice over where they go, thereby encouraging competition and a greater sensitivity to the needs of patients (Mills et al., 2002). Further benefits mentioned include the avoidance of confusion regarding the perceived value of the commodity, giving choice to consumers and, when going through the private sector, saving costs compared with distributing and selling PHPs through the public sector (Kweku et al., 2007, Roll Back Malaria, 2005).

Although focused on health services rather than PHPs, two systematic reviews by Bellows et al. (2011) and Brody et al. (2013) found strong evidence that voucher programmes for maternal health, family planning and sexual health have increased the utilisation of health services, but more limited evidence that they can improve the quality of service provision and target resources effectively to specific populations (Bellows et al., 2013). The same two reviews also highlight the need for stronger evidence on the cost-effectiveness of voucher-based programmes. It has also been noted in other studies that there are various obstacles that can prevent voucher redemption, particularly among the poorest, such as lack of stock in retail outlets, loss of vouchers, no perceived need for the product and not having knowledge of where to go to redeem the voucher (Bellows et al., 2013, Jones and Mponda, 2006, Kanya et al., 2014).

As Table 4 shows, there has been a wide variety in terms of the scale of recent PHPS programmes, with some local and/or pilot projects and others operating on a national or even multi-national scale. Levels of subsidy involved in the new programmes also vary widely. There are various programmes and campaigns that involve the distribution of fully subsidised products, such as the many free ITN campaigns seen in recent years (Hightower et al., 2010, Macedo de Oliveira et al., 2010, Renggli et al., 2013) and free distribution of ACTs for children under five and pregnant women through health care facilities (Alba et al., 2010). Among the partial subsidy programmes reviewed by the author, there were subsidies of 80% of the market price and more for ACTs, and between 25% to 91% for partial ITN subsidy programmes (Table 4).

As well as developments in practice, there have also been some advances in the justifications and theory behind PHPSs, although some of this has to be inferred from more general justifications around public intervention in health. Justifications for current PHPSs seem to be based upon a mixture of the presence of market failures and more ethical concerns with roots in the concept of extra-welfarism, where equity may trump efficiency concerns (Brouwer and Koopmanschap, 2000, MacLachlan and Maynard, 1982, Mooney, 1992) and, more recently, health as a human right (Backman et al., 2008, Pillay, 2008, The Lancet, 2008).

Regarding market failures, Hanson has argued that the failure of perfectly competitive markets in the case of malaria control justifies extensive public intervention (Hanson, 2004). For Hanson, the presence of a range of market failures associated with monopoly, public goods and externalities and informational failure are pervasive. In addition, cultural barriers to acceptance of particular PHPs may also exist (Ensor and Cooper, 2004). Dupas (2014) also alludes to failures in credit markets in LMICs as breaking down the logic of standard economic theory and providing a rationale for subsidisation. The main justification Dupas puts forward is that the majority of households cannot afford essential health products at their retail price due to credit constraints. As with Hanson, she also highlights the potentially large positive externalities arising from the use of such products in the form of public health benefits (especially when the PHPs tackle communicable diseases) and highlights that subsidies can help people to experiment and learn how valuable products are, including through social learning among non-beneficiaries. A further economic justification for health interventions in general that has re-emerged is based on avoiding the associated costs of morbidity, such as work hours lost due to illness (Purdy et al., 2013).

Hanson provides a list of principles to which public interventions should adhere in order to remain justifiable. These include: cost-effectiveness; equity of impact; affordability to government; crowding-in ('pump-priming') of the private sector and associated impacts on total use; and avoiding cross-border leakage (Hanson, 2004).

While crowding-out typically comes with negative connotations, a recent key justification for subsidising improved anti-malarial medication in the AMF-m is that this may help to have positive crowding-out effects of inferior monotherapies (Arrow et al., 2004, Sabot et al., 2009).

One of the major recent debates in the PHPS literature has been over the issue of 'cost sharing' or, more specifically, the appropriate level of pricing for subsidised PHPs. At the

core of the debate it has been recognised that, given the high price elasticity of demand of many health products in LMICs, if the level of subsidy is too low then there is a danger of over-exclusion (excluding those who need and would use the product) and if the subsidy is too high then there could be a danger of over-inclusion (subsidised products reaching those who do not need it or would not use it or use it inappropriately in a way that does not improve health), assuming the targeting design allows for this (Bates et al., 2012, Dupas, 2014). What recent empirical studies have suggested is that the theoretical risk of over-inclusion may be much lower than previously thought. Typically, it has been argued that providing products for free may lead to individuals not using them appropriately and so it may be better to charge something for them (Easterly, 2006). However, more recently Dupas points to evidence from randomised trials which suggests that people are just as likely to use a product when it was highly subsidised or free than if they had to pay for it (Berry et al., 2012, Dupas, 2014). Dupas therefore argues that ‘for products with large social benefits, free distribution is the most cost-effective strategy for increasing coverage of essential health products and services’ (Dupas, 2014: 1280). The theoretical basis for this is that standard economic theory, which suggests it may be better to charge a non-trivial fee to target products to those who need them most, breaks down in the presence of credit constraints where people’s ability to pay is lower than their willingness to pay (WTP).

One area where there is a danger relating to high subsidies concerns the subsidisation of medication, such as anti-malarials. The reason for this is that if simply left to individuals as to whether or not to purchase the subsidised medication, there is a danger of overtreatment due to informational asymmetries in healthcare and limited use of diagnostic tests in LMICs. This has been found in the case of the AMF-m (Briggs et al., 2014, Cohen et al., 2014), meaning that at a minimum there is a problem of mistreatment and potentially diverting limited stocks of important medication, and at worst a danger of creating drug resistance.

Related to the cost sharing debate, there has also been much discussion recently within the literature on ITNs on developing the right policy mix of full and partial subsidies to achieve a rapid and equitable catch-up and keep-up of ITN coverage (Grabowsky et al., 2007, Lengeler et al., 2007, Roll Back Malaria, 2005, Sexton, 2011). That is, what the most appropriate, cost-effective and sustainable approach is to achieving rapid increases in coverage and maintaining them over the longer term. As part of this debate, there have been some studies more recently looking at the impact free nets have on demand for

partially subsidised nets (Eze et al., 2014, Gingrich et al., 2011b, Gingrich et al., 2014). However, although the main policy priority in this debate has been on how to maximise coverage of ITNs over the longer term, there has been surprisingly little empirical focus on the impact of subsidised products on demand for unsubsidised products. This is discussed in more detail in the following chapter.

Acknowledging the potential wider market impacts of PHPSs, there have been calls in some quarters for a more comprehensive approach to implementing and evaluating PHPS programmes (Hanson et al., 2001). This idea appears to have taken root by 2003, with calls for a ‘Total Market Approach’ to social marketing (Meadley et al., 2003). In general, this involves greater integration of social marketing programmes within the economy, focusing more on the demand side, and focusing on generic promotion rather than promotion of a single brand. One of the reasons behind this new approach is the desire to, over time, move away from the need for subsidies and to encourage sustainable commercial provision. Another factor behind the emergence of the Total Market Approach may be the recognition that high sales of subsidised products do not necessarily mean that there has been a significant increase in total coverage or total market size of the PHP being subsidised if subsidised products simply displace unsubsidised products.

In brief, PHPSs have a long history of widespread practice and general support though they did come under increasing scrutiny from the early 1990s, with some questions beginning to emerge regarding their impact on commercial provision of PHPs. While there continues to be some criticism of specific programmes and approaches, in general there appears to be a widespread acceptance within the health literature of the need to subsidise certain PHPs.

As in agriculture, in spite of a general increase in support for PHPSs, a number of questions, criticisms and debates continue, some of which have been briefly discussed. These include: challenges in targeting and reaching intended beneficiaries with subsidies and ensuring that the poorest are able to benefit; whether fully subsidised products will be used as effectively as partially subsidised products; impacts of subsidised products on the commercial sector; relative cost-effectiveness of different types of subsidy; and the appropriate role of the private sector. Further details of the main topics are provided in Appendix 4.

2.4 A brief cross-sector synthesis

This section draws together a number of findings from the foregoing review. After giving a broad overview, the section focuses in particular on similarities and differences related to the impacts of, and challenges associated with, AISs and PHPSs. It is through the discussion of the challenges that the topics for empirical analysis are identified.

Fundamentally, AISs and PHPSs both aim to overcome the same basic problem, which is that, left to the market, the use of agricultural inputs and PHPs in many LMICs will typically tend to be below that deemed socially or economically optimal or desirable. However, while sharing a common broad justification, there have been considerable differences in the general willingness to use them over time. In agriculture there has more often been a sense that justifications must be grounded firmly on an economic basis, perhaps partly due to inputs often being seen as private goods, while PHPs are often justified on public health grounds. In agriculture, there has also been a longstanding argument that other public investments may be more cost-effective in achieving the end goals (e.g. agricultural productivity or poverty reduction). However, more recently there has been a common resurgence in the use of subsidies in both sectors, including a move towards justifying subsidies as a means of helping to develop private sector markets. There has also recently been some tendency in both sectors to target more narrowly and to use vouchers, though free PHP campaigns remain common in health and the specific mechanisms used for identifying beneficiaries have differed, as discussed further in the following chapter.

2.4.1 Impacts

One factor that may partly underlie sectoral differences in the perceptions of AISs and PHPSs is that, in many respects, the implementation of PHPSs is somewhat less problematic than in AISs due to the shorter and simpler impact pathway required in order to achieve the end objectives of most programmes. Figure 8 and Figure 9 set out these potential pathways, drawing on the review of the theoretical and empirical literature. In health, beyond achieving the impacts of increased ownership and use of PHPs, subsidies on PHPs are generally aimed towards the outcome of improved health among beneficiaries and in some cases improvement in the health of the wider community. The main challenges therefore are focused particularly around ensuring appropriate targeting, timely delivery and effective use of the PHPs. By contrast, in agriculture, the challenges of reaching intended beneficiaries and ensuring appropriate use of inputs represents more

of a first stage of challenges in the impact pathway. The main benefits from subsidised inputs arise after some time delay following their use and are dependent upon a range of factors such as crop yields and total output (themselves dependent upon agro-ecological conditions, research and extension, farm management, the weather and complementary investments among others), crops planted, and demand and supply of labour. While some benefits may be gained at this level (e.g. through improved physical access to food and nutrition and wage labour), further benefits such as financial access to food, improvements in household income, welfare, and health will then be dependent upon a wide range of further intervening factors, such as storage capacity, local market conditions, power asymmetries between buyers and sellers, availability of savings and credit facilities, and government food and trade policy. Longer-term effects that may arise, such as structural changes in cropping patterns, will be dependent upon earlier impacts and the specific modalities of the programme and context-specific factors. In brief, a cursory reflection on the impact pathways reveals just how much more complicated it may be in achieving some of the desired outcomes in agriculture compared to health.

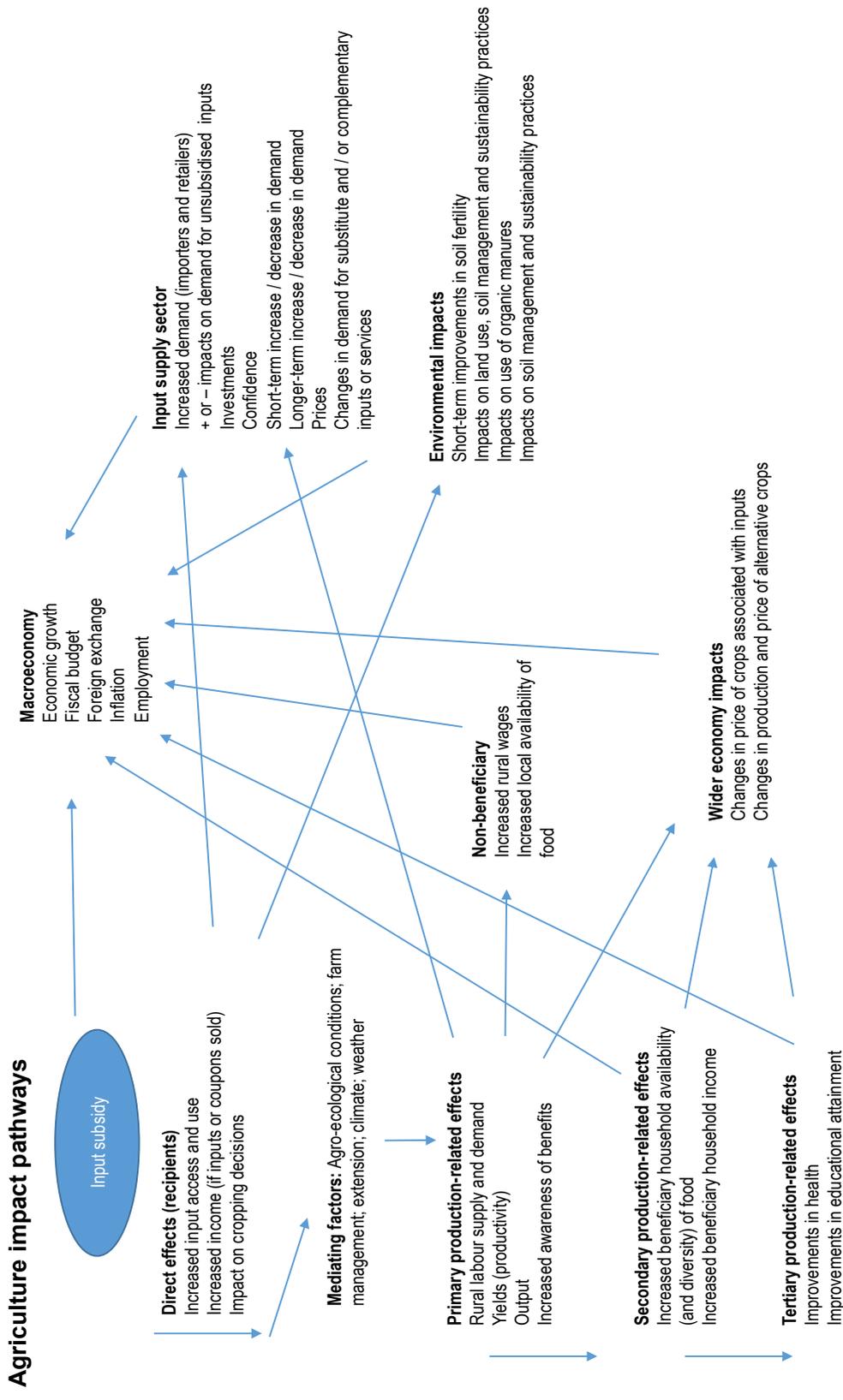


Figure 8: Agricultural input subsidy impact pathways
 Source: Author.

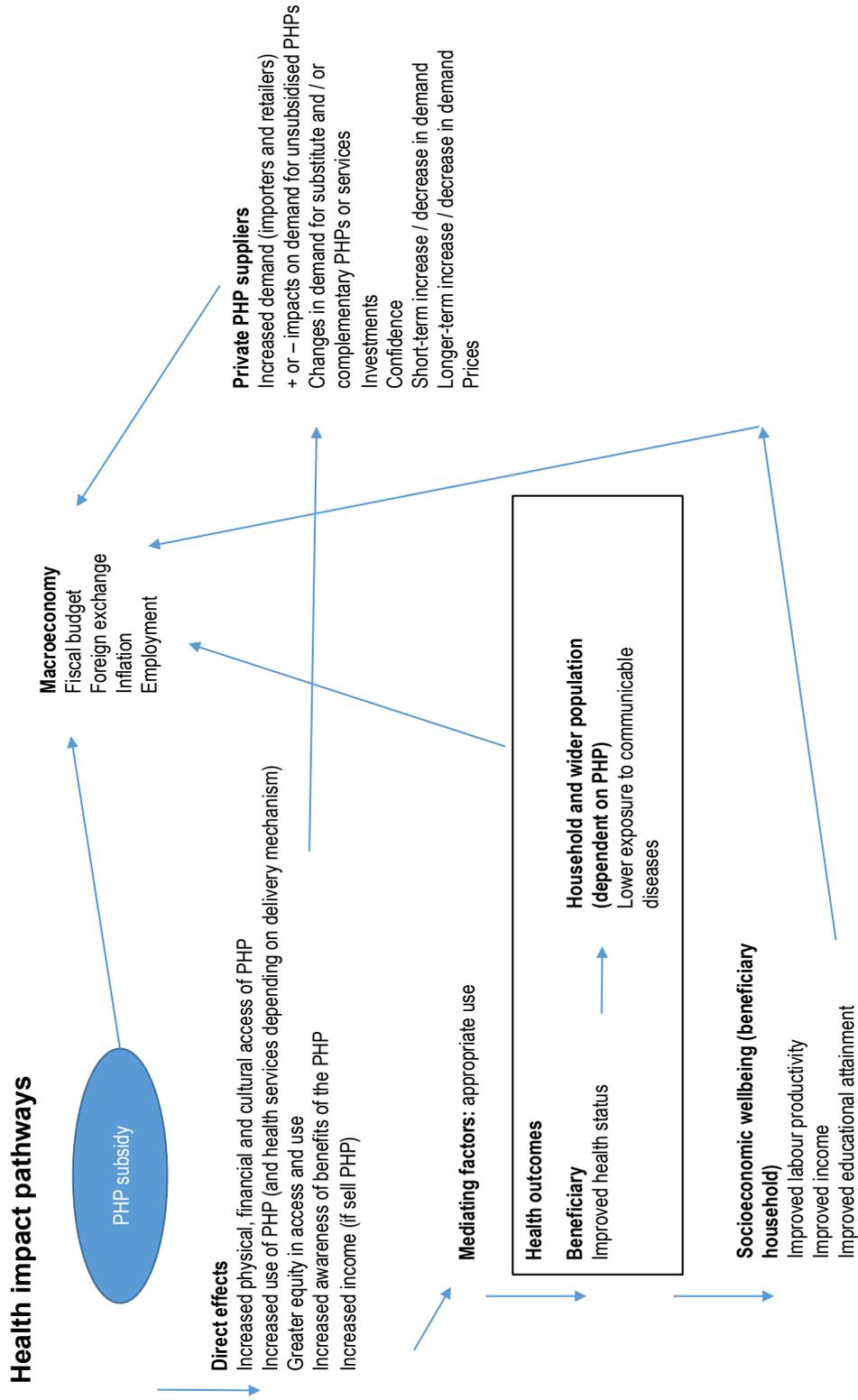


Figure 9: Public health product subsidy impact pathways
Source: Author.

2.4.2 Challenges

Particularly for the purpose of highlighting potential policy-relevant research questions, it is helpful to compare and contrast the main design, implementation and impact-related challenges identified in both sectors. These are summarised in Table 5, based on the systematic search and review of impact studies. As can be seen, a number of similar problems are faced, though there appear to be more in the case of AISs, which is in part due to the more complex nature of the impact pathways as just discussed. It is also true that agricultural input subsidies (particularly fertiliser subsidies) involve products, which are of substantial value and demonstrate high levels of demand in local, national and international private markets, which may increase the challenges associated with diversion, leakage and re-sale, political demands for continuation, and cost containment. There are also some differences in the extent to which challenges are recognised and dealt with in the respective theoretical and empirical literatures.

A few key similarities and differences are briefly discussed. One difference is in the approach to the private sector. Whereas in agriculture a key challenge is seen to be not using it enough or undermining it, in health, while there is some acknowledgement of the need not to undermine it, this occupies a far less central position and in addition there is a literature highlighting various challenges of using the private sector and the need for appropriate regulation, as indicated earlier. With calls in the agricultural sector to increase use of the private sector, there may therefore be potential scope for those in agriculture to learn from the experience in health.

Another related difference is found in terms of the common challenge of ensuring beneficiaries only pay the intended amount for subsidised goods. Whereas in agriculture there has been evidence of price hiking occurring from public outlets, e.g. (Dorward et al., 2014, Dorward and Chirwa, 2011b), there are examples in the health sector of it occurring in the private sector, e.g. (Sabot et al., 2009). This cross-fertilisation of evidence can help to provide both sectors with greater perspective if thinking about making greater use of alternative delivery mechanisms to avoid price hiking.

A further insightful difference is the seemingly different levels of emphasis placed on the issue of diversion and rent seeking. Whereas in agriculture these topics generally receive considerable attention, they have received far less attention in health. Some exceptions include certain internal evaluations, e.g. (Nathan et al., 2007, Nathan et al., 2008) and a recent study by Dupas which pointed to an audit study of ITN distribution programmes that found limited corruption among prenatal nurses (Dupas, 2014). However, Dupas

acknowledged corruption may be a bigger problem and that more research was needed. Her concerns seem to be validated by the fact that, since the writing of this thesis began, the Tanzanian ITN voucher programme which is the subject of empirical analysis in chapter six, has been discontinued due to evidence of systematic corruption in the e-voucher distribution system. This therefore further underscores the common challenges faced by voucher subsidy programmes in both agriculture and health.

Finally, two of the major inter-related challenges facing both the agricultural and health sectors are how to most effectively reach intended beneficiaries and the impact that subsidies have on the demand for, and sales of, unsubsidised equivalent products (i.e. whether they crowd-in or crowd-out unsubsidised sales). In terms of reaching beneficiaries, there has been a particular emphasis in the health literature on measuring how equitable targeting outcomes have been. In agriculture, ensuring that wealthier households do not capture subsidies has also been a longstanding concern. Regarding crowding-in / -out, while there is a common concern over possible impacts, there are differences in the level of attention given to the issue empirically, with a greater focus on it within agriculture. Closer investigation of the literature on these two topics in the following chapter demonstrates particular scope for cross-sector learning as regards to the use of methods as well as addressing empirical gaps in the literature.

Table 5: Key challenges facing design and implementation of AISs and PHPs from their respective literatures

Key challenges	Agriculture	Health
<i>Targeting</i>	Reaching intended beneficiaries. Avoiding capture by wealthier households.	Reaching intended beneficiaries. Ensuring socioeconomically equitable outcomes. Reaching the most physically remote.
<i>Leakage, diversion and rent-seeking</i>	Major concern and key criticism of AISs.	Limited empirical investigation and somewhat less attention given.
<i>Timeliness of delivery</i>	A crucial challenge encountered in many programmes for ensuring that inputs can be used effectively in the upcoming agricultural season.	Timeliness of access particularly important in the case of PHPs used to treat medical conditions (e.g. antimalarial prophylactics).
<i>Ensuring beneficiaries do not pay above the subsidised price.</i>	Have been concerns over rent seeking leading to hiking of beneficiary's financial contribution.	Some concerns over private retailers selling subsidised PHPs for more than the suggested price (e.g. AMF-m and Tanzania's TNVS).
<i>Use of private sector and impacts on unsubsidised commercial demand</i>	Concern over governments not using private sector appropriately, with assumption private provision is more desirable than public. Also, a longstanding concern due to negative effects on private sector and lowering production returns and cost-effectiveness of subsidy programmes. Concern arising from a sense that it is the private sector that should be providing inputs.	Some concerns over addressing the negative aspects to delivering PHPs via the private sector. Some growing concern since the 1990s of subsidies displacing unsubsidised demand though is often trumped by focus on achieving short-term health gains. Some investigation into impact of free PHPs. Main concern arising due to interest in future sustainability of access.
<i>Containing fiscal costs and high opportunity costs</i>	A major concern given the many additional and complementary investments also needed to raise agricultural productivity as well as many criticisms levelled at performance of AISs, including capture by local elites or politicians, poor targeting, and challenge of capturing the full benefits.	Less of a concern.
<i>Evaluating cost-effectiveness and estimating the full range of benefits</i>	A considerable challenge given the wide range of indirect effects. As such, impact evaluation has tended to focus on particular individual impacts.	Not such a concern as main impacts generally easier to trace, though is a gap in the literature on wider impacts, including more limited evidence on health outcomes. As such, reviews of cost-effectiveness of different delivery mechanisms relatively straightforward by comparison.
<i>Tendency for subsidies to persist due to political demands</i>	Longstanding concern within the literature.	Not really discussed as a problem.
<i>Sustainability of increased access / use and how to bring about graduation and/or exit from subsidies</i>	Major concern, related to worries over impacts of programmes and the persistence of subsidies and growing fiscal costs.	Emphasis less on phasing out subsidies but how best to maintain coverage and use of PHPs using a combination of free and partial subsidy policies.
<i>Ensuring appropriate use of inputs / PHPs</i>	Use of inputs not well considered in the literature, with most focus simply on reaching intended beneficiaries. Main related concern in past has been on overuse arising from persistence of subsidies.	Sizeable focus within the literature on the importance of effective and appropriate use of PHPs in terms of bringing about intended benefits.

Production-related		
<i>Ensuring increased production leads to increased domestic availability and lower staple prices</i>	Noted that fertiliser subsidies may often not do much to bring down the market price of staple crops to which subsidised fertiliser applied. Requires coherent grain and trade policies.	N/A
<i>How to maximise income-related benefits for beneficiary households?</i>	Noted in a couple of studies that there may be challenges in bringing about longer-term wealth impacts.	N/A
<i>Crop consolidation or diversification?</i>	Debate over whether AIs hold back or encourage diversification of crops.	N/A
<i>Negative environmental impacts</i>	Longstanding concern over encouraging overuse of inputs and intensification of farming leading to land degradation. Major questions over how to incorporate environmentally sustainable practices.	N/A

Source: Author.

3 Targeting and crowding-in /crowding-out: a review

Having identified the two inter-related challenges of targeting and crowding-in / crowding-out for further investigation, this chapter reviews the specific literatures on these two topics in more depth. Through a critical review of these literatures across both sectors, the chapter demonstrates the empirical gaps to be addressed by the following three chapters of this thesis. The topic of targeting is reviewed first, followed by crowding-in and crowding-out.

3.1 Targeting: theory and practice

The issue of who ends up directly benefiting from AISs and PHPSs is of fundamental importance to the overall effectiveness and efficiency of the programmes or policies in question. This section critically reviews the empirical literature on who has directly benefitted from subsidies in both sectors along with the empirical methods used, leading to the identification of a gap in the empirical literature around targeting in AISs. The theory and evidence on the determinants of targeting outcomes in agriculture is then reviewed. To provide some context, the section first of all reviews current thinking in each sector over who should be targeted, different approaches to beneficiary selection, and mechanisms for transmission of subsidies to identified beneficiaries.

3.1.1 Targeting in theory and practice: agricultural input subsidies

3.1.1.1 Who should be targeted?

There are a few different perspectives within the literature on AISs as to who should be targeted with subsidised inputs. Some authors and donors appear to implicitly or explicitly believe that it should be the poorest households that are targeted, including highly food-insecure farmers (Denning et al., 2009, Houssou and Zeller, 2011, United Nations, 2005). This could be seen as a social protection or safety net argument, where the emphasis is on household-level poverty reduction objectives. However, it is recognised by a number of authors that for the very poorest with labour constraints or no land, they may require an alternative or complementary social protection measures such as cash transfers (Denning et al., 2009, Dorward, 2009). Others are more sceptical, arguing that the use of fertiliser subsidies to pursue welfare goals (alleviating poverty or reducing hunger) will often be inappropriate and that there are other more cost-effective

instruments for achieving such goals (Morris et al., 2007). However, there is some evidence to suggest that input subsidies could be more welfare-efficient compared to cash transfer programmes under certain conditions (Filipski and Taylor, 2012).

An alternative perspective, adopted in Zambia's Fertiliser Support Programme, starts from the assumption that raising aggregate output of food supplies should be a core objective of AISs and therefore emphasises the importance of targeting farmers who make the most efficient use of subsidised inputs (Mason et al., 2013). A variant of this view would argue that subsidies be targeted to areas where additional inputs would contribute most to improving yields (Minde and Ndlovu, 2007). However, there is a danger that such an approach may lead to targeting of farmers who would purchase inputs anyway, limiting the contribution that the subsidy has to incremental use of the inputs and, if subsidised inputs are sold through public outlets, crowding-out the private sector input industry (Dorward, 2009, Morris et al., 2007, Ricker-Gilbert et al., 2011).

Other authors have noted how sometimes overall programme objectives can explicitly or implicitly result in conflicting targeting criteria, most clearly if there is a dual objective of boosting aggregate output at the same time as raising incomes among poor smallholder households as the groups that should be targeted are not necessarily the same (Kelly et al., 2011, Pan and Christiaensen, 2012).

A further perspective found in the literature is that AISs should be targeted at farmers whose input use is constrained by market failures, e.g. those who would not be able to afford commercial fertiliser, for the primary reason that it limits costs and would be the most efficient way for a programme to contribute to raising incremental input use and the development of commercial input markets. Ricker-Gilbert et al. (2011) note a potential trade-off of lower national crop output if targeting those who do not already purchase inputs, though tentatively conclude that poorer households may be as efficient in using fertiliser as wealthier households. However, this may not apply to the very poorest, disabled or otherwise labour constrained households.

Finally, some authors have recently noted that, given the difficulties of effectively targeting poor households, in some contexts (e.g. where the cost of commercial inputs is high and poverty widespread), better poverty and vulnerability focussed targeting outcomes may be achieved by targeting all smallholder households with a tightly rationed subsidy (Dorward and Chirwa, 2013b, Holden and Lunduka, 2012b).

In practice, a range of criteria have been used for beneficiary selection in different programmes as summarised in Table 6, including being a member of a farmer or other

group, and a combination of being land-poor and belonging to particular vulnerable groups.

3.1.1.2 Theory and approaches to beneficiary selection and transmission of subsidies to beneficiaries

Targeting of AISs typically takes place at the area level (i.e. regional, district and below) and beneficiary level. The focus here is on the beneficiary level, where a range of mechanisms are used to identify beneficiaries (Table 6). One of the more popular approaches has been to use community-based targeting (CBT). This typically involves village committees, local leaders and / or other stakeholders such as government extension agents. Aside from generally having lower administrative costs than means-based targeting, the main theoretical arguments behind this approach include: benefiting from the information that local governments or communities are thought to have about the conditions of potential beneficiaries and local needs and preferences (Mansuri and Rao, 2012); it being easier to hold local decision-makers accountable compared to centralised decision-makers (Bardhan, 2002); and having the potential to strengthen social capital, community organisation and beneficiary empowerment (Fox, 1996). However, in certain contexts CBT may be prone to elite capture by those who hold positions of local authority or be used as a vehicle for patronage (Ellis, 2007, Pan and Christiaensen, 2012).

Another variant of decentralised targeting has been to use extension agents, as in Ghana. Some benefits of this approach are thought to include it facilitating dissemination of information about extension services including efficient and profitable use of inputs and discussions around farming practices (Vondolia et al., 2012). By contrast, programmes in Zambia and Nigeria have used membership of farmer or other local groups as criteria for eligibility, sometimes with the group leaders playing a central role. This approach may help to encourage formation of community groups, which could themselves be of benefit to farmers. However, there is a danger that the approach could miss some poorer farmers along with some evidence that if there is subsequent distribution within groups then there may be a danger of personal relationships playing a role in the amount of inputs beneficiaries acquire (Liverpool-Tasie et al., 2010).

In terms of reaching identified individuals, one of the main recent developments is the use of vouchers, which are given to beneficiaries and can then be redeemed, usually

following a co-payment, for specific inputs at private or government outlets. Direct distribution of inputs does also continue to take place in some cases.

3.1.2 Targeting in theory and practice: public health product subsidies

3.1.2.1 Who should be targeted?

The dominant view on targeting within the health literature comes from a public health perspective, which focuses on targeting as a means of maximising public health benefit (Roll Back Malaria, 2005). From this perspective it would be attractive to target mosquito net subsidies, for example, to pregnant women and mothers of young children as this can help extend benefits not only to mothers but also young children sleeping with their mother. Furthermore, pregnant women and young children are especially susceptible to malaria as such women lose their acquired immunity and young children will not yet have it. Also, malaria during pregnancy can lead to highly adverse outcomes for both mother and child. The emphasis on public health objectives can also be seen in the targeting of children through attendance at maternal and child health clinics or immunisation programmes as this can provide incentives for their attendance and therefore access to health services. Within the public health view, there is also a strong emphasis on reaching poorer households and achieving equitable targeting as it is recognised that it is often the poorest households that miss out on access to PHPs (Worrall et al., 2005). However, there also appears to be a tension between two variants within the public health perspective. One is driven in part by international donors and global targets and emphasises the importance of achieving rapid short-term equitable gains.⁷ It is therefore supportive of universal (free) campaigns. The other emphasises the importance of targeting so as to maintain longer-term improvements by not undermining the private sector upon which future access may depend, and to ensure that limited resources are used in the most cost-effective way (Roll Back Malaria, 2005). In general, the dominant view has been that which focuses on increasing access in the short-term (Hanson et al., 2001).

⁷ Personal communication with official working within the Tanzanian NATNETS programme.

Table 6: Summary of targeting features from selected AIS programmes

Programme / country	Ghana fertiliser subsidy	Zambia Fertiliser Support Programme	Nigeria voucher pilot	Tanzania Agricultural Input Voucher Scheme	Zambia Security Pack	Malawi Farm Input Subsidy Programme
Start year	2008	2002	2009	2009	2000	2005
Beneficiary criteria	No criteria based on income or crop (though subsidised fertilisers were not special cocoa formulations)	Membership of a cooperative society	Being a member of a farmer group (Kano district) or any other organised local group (Taraba district)	Full-time resident maize or rice farmers with less than one hectare who are able to finance subsidised inputs. Among eligible farmers, priority to female-headed households and those who did not use improved inputs in the last five years.	Land-operating (but land-poor) households with unemployed labour. Particular focus on vulnerable groups (households of elderly, disabled, orphaned or unemployed youth).	Resource poor residents of a village that hold a voter identification and own a piece of land to be cultivated in the upcoming season. Priority given to vulnerable groups (i.e. elderly or those looking after them, HIV-positive, female- or orphan-headed households and the disabled).
Mechanism for beneficiary selection	Extension agents gave vouchers to farmers	Membership of a cooperative society	In Taraba, vouchers distributed to all members of selected organised groups from a central point on a pre-arranged day. In Kano, one voucher given to leaders of farming group on submission of their certificate of registration and payment from each farmer.	Village voucher committees draw up list of beneficiaries for approval by village assembly	Lists created by village heads and reviewed by local committees (Community Welfare Assistance Committees and Area Food Security Committees)	Open forums to identify beneficiaries with a key role played by a village development committee
Transmission of subsidy to selected beneficiaries	Voucher holders redeem them at private outlets for fertiliser upon payment of a cash top-up	Government distribution to cooperative societies	Vouchers redeemed at accredited private agricultural input dealers in their local area. In Taraba done by individual farmers, in Kano, bulk purchase and subsequent distribution among members.	Voucher holders redeem for inputs at private agro-dealers (includes complementary support to improve efficiency of input use and improve input supplier skills)	NGO provides packs to beneficiaries through a network of district-based NGOs	Voucher holders redeem them for inputs at local parastatal depots (fertiliser) or private agro-dealers (seed)
References	(Banful, 2011, Vondolla et al., 2012)	(MoAC, 2011)	(Kiger and Adodo, 2010, Liverpool-Tasie et al., 2010)	(Minot, 2009, MoAFSC, 2012, World Bank, 2009)	(Ellis, 2007, Jorgensen and Loudjeva, 2005, Kodamaya, 2011)	(MoAFS, 2012)

Source: Author. Note that programmes are subject to numerous changes over time.

In practice, targeted PHPS programmes focus on different types of individuals, depending on the programme objectives. For example, many subsidy programmes for mosquito nets and malaria medication have focused on pregnant women and their children (Agha et al., 2007, Grabowsky et al., 2007, Hanson et al., 2009, Noor et al., 2007, Webster et al., 2010); subsidies on nutritional and oral rehydration products have been targeted to caregivers of young children (Kassegne et al., 2011, Wang et al., 2011); and some contraceptive subsidies are targeted specifically to certain younger age groups (Plautz and Meekers, 2007). Such targeting is often referred to as categorical.

3.1.2.2 Theory and approaches to beneficiary selection and transmission of subsidies to selected beneficiaries

A range of mechanisms used for beneficiary selection and transmission of subsidised PHPs were shown earlier in Table 4. A number of recent ITN schemes have selected beneficiaries on the basis of categorical targeting by giving vouchers to women on attending antenatal care clinics (or the opportunity to acquire subsidised ITNs from there directly). One of the benefits of this in the case of ITN subsidies is that it is a fairly effective way of targeting those who may be particularly at risk of malaria. However, a potential downside from an efficiency perspective is that it does not in itself allow for targeting on the basis of ability to pay, meaning that subsidised products may end up displacing products that would have been purchased anyway.

Self-selection is the other common method for selecting beneficiaries as used in social marketing and other forms of direct subsidy, where individuals effectively select into receiving the subsidy by purchasing a subsidised product. Such approaches in theory allow for some form of discrimination whereby wealthier individuals may prefer to purchase other products that are of a different design or quality. However, in practice wealthier households may still prefer to purchase the subsidised product, meaning self-selection may not be the most efficient means of increasing coverage if it displaces unsubsidised sales.

3.1.3 The empirical evidence on targeting outcomes and methods used

3.1.3.1 Agriculture

Most recent studies in agriculture employ the use of multivariate regression analysis to measure targeting outcomes by estimating participation equations, where the dependent variable represents participation in the programme, such as the receipt of vouchers, number of vouchers received or the amount of subsidised inputs received. A number of household characteristics and other variables are then included as explanatory variables (e.g. farm size, livestock ownership and gender of the head of household). For example, concerning Malawi's FISP, a number of quantitative studies link particular household characteristics with targeting outcomes, such as receipt of subsidy coupons or the amount of subsidised inputs households have received.⁸ Results from these studies generally suggest that the benefits from the FISP have increased with measures of socioeconomic status (SES), such as the value of household assets and land size (Chibwana et al., 2012, Holden and Lunduka, 2010a, Holden and Lunduka, 2010b, Kilic et al., 2013, Ricker-Gilbert and Jayne, 2011, Ricker-Gilbert et al., 2011).⁹ In one of the more recent studies, Kilic et al. conclude that 'the relatively well-off rather than the poor or the wealthiest, and the locally well-connected have a higher likelihood of program participation and, on average, receive a greater number of input coupons' (Kilic et al., 2013). This is despite the fact that the FISP has formally aimed to target resource poor and vulnerable households.

A review of evidence from AISPs in SSA concluded that in three out of the four countries covered (Ghana, Zambia and Malawi), wealthier and more politically connected households captured a higher proportion of the overall subsidy (Ricker-Gilbert et al., 2013a). Only in a pilot project in Nigeria did participants in the voucher subsidy programme tend to be poorer than non-participants (Liverpool-Tassie, 2012).

One exception to the general trend of relying on multivariate regression is the study by Kilic et al. (2013), which also calculated two national targeting coefficients, drawing on the work of Galasso and Ravallion (2005) and Stifel and Alderman (2005). The first was based on the difference between the share of the 'eligible' population participating in the programme (coverage) and the share of the 'non-eligible' population participating

⁸ The term coupon is used in the context of the FISP and refers to a subsidy voucher.

⁹ Some exceptions to this include Chibwana et al. (2012) finding a negative association between farm size and receipt of maize seed and Holden and Lunduka finding a negative association between receipt of a fertiliser coupon and value of household assets (2010a). However, these may be due to sample effects, with these three studies drawing on a much smaller sample.

(leakage). The other coefficient was based on the difference between the average value of subsidy received among the eligible population and non-eligible population. Indicators of eligibility used included: being in the bottom 40% of either annual household per capita consumption expenditure, wealth index values or total landholding.

A second exception is a study by Osorio et al. (2011), which used benefit incidence analysis to investigate the relationship between land size and the proportion of the total fertiliser subsidy value received in Indonesia (incorporating the price paid for the fertiliser) and found that farmers in the top two quintiles (those with most land) received 60% of the total subsidy; more than that received by all of those in the poorest three quintiles.

One of the problems in these studies is that many of them tend to focus in particular on the relationship between a specific asset (e.g. land or livestock) taking it alone to be a reliable proxy for SES. However, there is a danger that reliance on single assets may provide misleading results. For example, some recent estimates for Malawi suggest that there may be less of a direct relationship between wealth and land size than is typically assumed (Houssou and Zeller, 2011: footnote 628). Similarly, ownership of livestock may well depend on geographical or other factors.

A second problem is that the multivariate regression methods used in most studies generally provide single coefficients to represent the relationship between a particular wealth indicator and targeting outcomes. This tends to present relationships as linear and does not allow for a comprehensive understanding of how outcomes may differ as wealth indicators change. There are one or two exceptions to this. For example, the study by Osorio et al. (2011) on Indonesia does look at how the distribution of subsidy expenditure differs across quintiles using benefit incidence analysis and some studies using participation equations use categorical variables for wealth groups (Kilic et al., 2013), giving different estimates for those in different wealth categories. However, neither offers a measurement that fully accounts for the continuous nature of targeting outcomes.

A further limitation of the studies is that while they focus on the distribution of subsidies, they ignore how wider programme impacts as identified in theory and empirical evidence, e.g. (Dorward, 2009, Piggott et al., 1993, Tiba, 2010, Tower and Christiansen, 1988) accrue among individuals within different socioeconomic groups within society. Estimating such effects is clearly a far more challenging task, though is one that should be taken up as, unlike PHPSs, some of the main benefits of sufficiently large-scale AISP may arise from impacts on staple food prices and on the labour market (Dorward, 2009).

3.1.3.2 Health

In contrast to the AIS literature, the literature on PHPSs appears to have used some quite different methods and tools for estimating targeting outcomes. Given the importance attached to equity, a number of studies have incorporated some form of equity analysis, which has broadly involved stratifying households into SES groups from poorest to least poor based on an asset index and then applying one of a number of methods to estimate relative inequality in access to / use of the subsidised PHPs across these groups over time. Table 7 provides a basic overview of two of the most common methods in the PHPS literature: equity ratios and concentration curves (CCs) and concentration indices (CIs).

In terms of the general empirical findings the evidence points overwhelmingly to the conclusion that PHPSs can help increase the overall equity in coverage or use of the particular PHP being subsidised (results are presented more fully for a range of programmes in Appendix 5). However, in terms of targeting, a number of studies highlight the fact that reaching the poorest with subsidies does remain a challenge (Hanson et al., 2009, Sabot et al., 2009).

While there will be study-specific weaknesses and limitations in addition to those mentioned in Table 7, given the limitations noted earlier with regard to methods used in the agricultural literature, there may well be useful lessons that can be learnt from the application of methods used in the health literature to extend and update estimates of targeting outcomes in AISP. As mentioned, with few exceptions, the AIS literature has restricted itself largely to the use of multivariate regression analysis for measuring targeting outcomes, which provides a limited and not particularly intuitive output for policy-makers. By contrast, CCs would allow for the full distribution of targeting outcomes within a given sample to be measured and displayed in an intuitive visual manner as a continuous variable in relation to the socioeconomic status of all households. These may be used in combination with CIs to allow for numerical statistical testing of changes over time or between areas.

Table 7: Summary of methods used for measuring equality in PHPS programmes

Source: Author's summary.

Method	Brief description	Main strengths	Main weaknesses
Equity ratio	A ratio of some measure of access or use among the poorest and richest groups taken as a relative measure of equity.	Straightforward measure. Easy to explain. Allows for comparison over time or between programmes.	Ignores the distribution among middle quintiles and may obscure inequalities.
Concentration Curves and Concentration Indices	A CI is a value ranging from -1 to 1 giving an indication of how the cumulative share of a health outcome is distributed by a measure of SES. Zero denotes perfect equality and a negative (positive) figure suggests a concentration among poorer (less poor) households. CIs are derived from a concentration curve (CC), which plots the cumulative proportion of a health variable (y-axis) against the population ranked by SES (left to right on the x-axis). The CI provides a measure of the area between the CC and a 45° line of perfect equality.	CIs are a more comprehensive measure than equity ratios. Allows for comparison over time or between programmes. CIs can be standardised to control for the influence of 'legitimate' causes of inequality in a health outcome (e.g. age). Can decompose the CI into factors contributing to greater or lesser inequality.	Conceptually somewhat less easily explained and understood than equity ratios. CIs presented without a CC may give a limited or misleading idea of the actual distribution by SES.

Malawi's FISP lends itself to being a particularly good case study through which to apply CCs and CIs. As explained further in the following chapter, it benefits from having nationally representative household survey data over a number of years since the programme began in 2005/06. There is also a need to update the measurement of targeting outcomes following a number of changes to the programme using more recent household survey data.

Given that previous evidence has suggested that the direct benefits in the FISP increase with measures of socioeconomic status, it is also of interest to know what the key factors are which underpin targeting outcomes at the community level. The remaining discussion therefore reviews the literature around determinants of targeting outcomes under the type of targeting used in the FISP, and the related evidence.

3.1.4 Determinants of targeting outcomes under community-based targeting

As with a number of other AISP, Malawi's FISP uses a form of CBT, as explained in more detail in the following chapter. It was mentioned above that while there are a number of theoretical advantages to this approach it can also suffer from some significant weaknesses, such as elite capture and patronage.

There are a number of theories that are pertinent to the determinants of targeting outcomes under CBT and which can help in understanding what outcomes we might expect to see. The relevance of these will of course depend upon the specific arrangements and local socio-political context.

One of the key theories of relevance is that around elite capture of the benefits of programmes that use decentralised targeting methods. In general, the ‘elite’ is typically taken to refer to those who hold positions of power, such as local leaders, committee members and officials. Pan and Christiaensen (2012) point out that depending on the targeting criteria, elite capture may worsen or improve performance. For example, if the elite are themselves more productive then it may improve targeting in a programme where productivity is the main criterion, while it may worsen performance if the elite are generally wealthier and poverty is the main criterion.

The same authors cite a number of studies which suggest that a range of political, economic, sociological and programme design features can all explain the likelihood of elite capture in different contexts. These include the programme’s size, eligibility criteria and whether it involves the distribution of public or private goods (Araujo et al., 2008, Galasso and Ravallion, 2005), local power structures (Bardhan and Mookherjee, 2006), levels of awareness (Bardhan and Mookherjee, 2000), income levels and poverty (Galasso and Ravallion, 2005) and community homogeneity (Seabright, 1996).

Pan and Christiaensen (2012) themselves found in their study of an input voucher programme in Tanzania that members of the local elite (households containing elected village officials) were more likely to be voucher beneficiaries and received around 60% of the distributed vouchers after controlling for the programme’s eligibility criteria.¹⁰ Elite capture was found to be more pronounced in communities with more unequal land distributions and that were further from rural towns. Trust levels in the village were found to be important counteracting factors along with the size of the programme.

A second theory related to elite capture is that of neo-patrimonialism, commonly used in the political science literature. The term has its roots in Weber’s concept of patrimonialism, which described forms of traditional top-down authority. Eisenstadt (1973) first distinguished this from neo-patrimonialism, which is taken to refer to a form

¹⁰ The targeting criteria were aimed at reaching literate households which were able to co-finance the partially subsidised inputs and which did not cultivate more than 1 hectare of maize and/or rice. Priority was to be given to female-headed households and those which used little or no modern inputs on maize or rice over the past 5 years (Pan and Christiaensen, 2012).

of organisation in which patrimonial relationships exist within a political and administrative system that is constructed formally on rational-legal lines (Clapham, 1985: 48). In such a system officials hold positions with powers that are formally defined but exercise those powers as far as possible as a form of private property rather than public service. There is however a form of reciprocity within the notion of neo-patrimonialism, with those in positions of authority transferring government resources to ‘clients’ in return for support (vanWyk, 2007). While neo-patrimonialism was popularised as a theory to explain the overall poor economic performance of Africa during the 1980s and 1990s (van de Walle, 2001), it is also applicable at a more local level in that the holders of positions of authority within a community or area may choose to distribute state resources (e.g. subsidised inputs) in return for some form of political support.

Very much related to the concept of neo-patrimonialism is the theory of rents and rent seeking. Khan (2000) defines the term rent as income which is higher than the minimum which an individual or firm would have accepted given alternative opportunities. In practical terms it can refer to a wide range of situations whereby those in government or who hold some position of power or authority can either be allocated or demand rents for a range of reasons, including personal gain or political support.

Finally, it is important to highlight that targeting performance may also be crucially mediated by the simplicity and clarity of the official targeting criteria themselves. Where a programme seeks numerous objectives and involves rather broad or conflicting targeting criteria, this in itself can create scope for confusion and difficulties in achieving any of the individual targeting objectives (Pan and Christiaensen, 2012).

3.1.4.1 The evidence on factors influencing transmission of subsidies to beneficiaries in Malawi’s FISP

There are various pieces of evidence to help build up a picture of what might be important influences in determining the transmission and use of subsidised inputs in Malawi’s FISP. However, this evidence remains scattered and does not yet provide a sufficiently comprehensive picture of the key factors influencing and determining these outcomes within specific communities.

Further details on the operation of the FISP are provided in the following chapter, though to interpret the evidence here it is important to understand some of its key features. At its core, the FISP involves the distribution of packages of coupons to selected farming

households through a CBT approach, which is supposed to involve several actors, including Ministry of Agriculture and Food Security (MoAFS) extension staff, local leaders and elected Village Development Committees (VDCs).¹¹ The packages are intended to provide recipients with a combination of inputs, which have changed over the course of the programme but as of 2012/13 included two types of fertiliser, improved maize seed and legume seed. Intended beneficiaries are supposed to be resource poor and there has been an increasing emphasis since the programme began on targeting vulnerable households. The use of ‘open meetings’ was introduced from 2008/09 to sensitise the communities about the operation of the FISP and to include them in the targeting process and remove power from traditional leaders. Recipients are supposed to redeem their coupons at accredited outlets for subsidised inputs, with a small top-up payment required for some, depending on the type of input. Inputs are then supposed to be used by the beneficiaries exclusively on their own land.

In terms of the evidence, first of all it was mentioned above that some quantitative studies have shown that those who are well connected have been more likely to receive subsidies (Kilic et al., 2013), which provides an initial indication of potential elite capture and neo-patrimonialism. However, this evidence alone does not help to explain the underlying processes that may be driving this.

The main sources of evidence that provide insights into what might explain targeting outcomes come largely from the independent FISP evaluation reports that include certain questions from quantitative household surveys on coupon allocation, distribution and redemption and make some limited reference to findings from focus group discussions (FGDs) (Dorward and Chirwa, 2011b, Dorward et al., 2013, SOAS et al., 2008). A fuller qualitative report based on focus group discussions, key informant interviews and life histories has looked at the challenges of access to the subsidy among the most vulnerable groups in the 2010/11 season (Mvula et al., 2011). Lastly, some limited insights are available from a separate published paper drawing on different quantitative and qualitative data from the central and southern regions (Holden and Lunduka, 2012b).

In the 2012/13 FISP household survey, the use of open meetings was reported by around 70% of respondents for coupon allocation and 80% for coupon distribution (Dorward et al., 2013). However, when asked who made decisions regarding coupon allocation, over 70% of households reported it to be the village head or local traditional authority.

¹¹ The MoAFS has since been renamed the Ministry of Agriculture, Irrigation and Water Development though MoAFS is used here.

Respondents from FGDs as part of the same evaluation round also reported traditional leaders to be predominant in making coupon allocation decisions as well as VDC members with some mention of agricultural staff. This conflicting evidence of local leaders making the decisions despite there being open meetings requires further explanation.

The study by Mvula et al. (2011), and to a lesser extent Holden and Lunduka (2012b), provide some further insights into beneficiary selection and coupon allocation. For example, Mvula et al. do not appear to find that lack of awareness of the targeting criteria was a problem, concluding that most people were aware of criteria and that problems in coupon access were isolated. However, they did note a number of challenges in the poorest accessing coupons, the most common being the splitting of coupon packages and sharing of coupons with other households, meaning households end up with less than the intended package, sometimes sharing the inputs associated with a single coupon. There was some evidence that local leaders may be behind this. Other less commonly reported challenges included: some village heads adding their own criteria; there being fewer coupons arriving than the number of registered beneficiaries; missing beneficiary names; and malpractices by officials and traditional leadership (e.g. capture and sale of coupons).

Holden and Lunduka (2012b) also find that splitting of packages was common in the 2007/08 and 2008/09 seasons (as have the aforementioned FISP evaluation reports) but they do not explain what was driving this. They also report evidence of a sizeable secondary market for coupons, which they argue may partly come from households that received coupons but were particularly poor and unable to use them, but mostly from leakages occurring before they reach recipients. Overall they argue that the weak targeting performance was particularly due to leakages of coupons and fertilisers before they reached households that should have been targeted and by unclear targeting criteria.

Once coupons are allocated they must be redeemed for inputs by beneficiaries. Again, there is some quantitative evidence that sheds light into this stage of the process, suggesting that the large majority (95%) of fertiliser coupons were used to buy fertiliser in 2012/13, with the main reason for non-redemption being lack of stock at selling points, though the reasons for lack of stock remain somewhat unclear (Dorward et al., 2013). Survey data relating to coupon use may, however, not be entirely reliable as coupon sales are a very sensitive issue (Dorward et al., 2013, Holden and Lunduka, 2012b). Reliability is likely to particularly affect the findings from large-scale surveys, which tend to be carried out quickly in a tick-box fashion without building a particular rapport with the

interviewee. However, it may also be a problem in the case of FGDs (where very few cases of coupon purchase and sales were reported) as they may not be an appropriate forum in which to allow all voices to be heard on sensitive issues and they may not encourage the same level of openness as interviews with individuals. Quantitative evidence suggesting high levels of redemption is also somewhat at odds with a range of quantitative and qualitative data from 2010/11 and 2012/13 that suggest fairly significant difficulties in accessing subsidised fertiliser in particular, including long queues, queue jumping, clerks and individuals demanding payment of tips and the involvement of vendors who have connived with clerks to get subsidised inputs illegally (Dorward et al., 2013, Mvula et al., 2011). However, it can be difficult to judge from qualitative research how extensive these problems are.

The limited evidence on subsidised input use suggests the large majority of fertiliser acquired in 2012/13 was used on farmers' own gardens (97% of all fertiliser received) in 2012/13 (Dorward et al., 2013). However, as noted in the evaluation reports, there are again potential questions over reliability, with re-sale being a sensitive issue. The use of multi-choice answers can also make it difficult to describe how inputs are actually used, though FGDs in the 2012/13 evaluation also reported almost universal use on the beneficiary's own field.

In brief, despite various evidence providing insights into factors that may be influencing targeting outcomes, it remains somewhat patchy and scattered. Given the evidence referred to above suggesting that intended targeting outcomes are not being achieved in the FISP, there is therefore a need to gather new primary data that can help identify and assess the importance of the key factors that influence and determine the transmission of subsidies to beneficiaries at each of the various stages from beneficiary selection, to coupon allocation, coupon redemption and subsidised input use.

3.2 Impact of subsidies on unsubsidised sales and incremental coverage

A second area in which AISs and PHPS share a common challenge, and where there exist certain gaps and weaknesses in the empirical evidence, concerns the issue of whether these subsidies crowd-in increased purchases of unsubsidised equivalent inputs or PHPs or whether they crowd-out unsubsidised sales that would have gone ahead in the subsidy's absence. The focus here is on sales of the same products, though there may also be impacts on sales of complementary or substitute products (see for example Holden and Lunduka (2012a) and Carneiro et al. (2012)). Knowledge of crowding-in or crowding-out is

crucial for understanding the impact that a subsidy programme has on the incremental increase in sales or use of the products being subsidised.

As mentioned in the previous chapter, recent thinking within both sectors emphasises the potential for subsidies to help develop private markets for inputs or PHPs through stimulating demand. However, the evidence base within health remains limited and that in agriculture seems to suggest that crowding-out effects are common and relate to targeting outcomes. Given that the extent of crowding-out will crucially determine the level of incremental increase in coverage or use arising from a subsidy programme, it is of great importance to further investigate crowding-out effects in PHPS programmes. The remainder of this section first considers how crowding-in and crowding-out are viewed and conceptualised in the agricultural and health literatures before looking at the relevant empirical evidence and methods used.

3.2.1 Theoretical background

3.2.1.1 How are the concepts viewed and conceptualised in agriculture?

The impact that AISs can have on private input markets has long been considered an important issue within the agricultural literature. For example, crowding-out was one of the major criticisms levelled against fertiliser subsidies provided through public distribution systems in the World Bank's 1986 World Development Report (World Bank, 1986). More recently, thinking within the smart subsidy paradigm has suggested that subsidising inputs may instead have a positive role to play in helping to crowd-in future commercial purchases by stimulating demand for them. On the one hand this is thought to operate by encouraging farmers to try inputs and recognise their benefits (IFDC, 2003) or by developing links between rural farmers and input suppliers (Liverpool-Tassie, 2012). On the other, providing the private sector is involved in selling subsidised inputs, it is thought that a large-scale subsidy may help to stimulate the development of input markets through increased demand helping the private sector to overcome start-up costs and capture economies of scale, which in the longer term could help to lower the commercial price of inputs, laying the foundations for further future commercial purchases (Morris et al., 2007).

Despite the recent interest in the potentially positive role subsidies might play in crowding-in, there is still considerable concern over crowding-out. This is thought to arise through a number of mechanisms. The main focus in the current literature has been on

subsidies reaching those who would have purchased unsubsidised inputs anyway, as the subsidy will then displace those purchases, reducing the effect a subsidy programme has on increasing incremental use of the input (Ricker-Gilbert et al., 2011, Xu et al., 2009).

In general, crowding-out within the agricultural input subsidy literature has been considered in the context of the public sector being used to sell subsidised inputs, with crowding-out therefore generally implying negative impacts upon the private sector. For example, in a study of the Zambian government fertiliser subsidy programme, Xu et al. (2009) show that where the private sector was already well established, crowding-out was more likely compared to where there was lower private sector penetration. A further aspect to this is that, even if initial private purchases are low, if a subsidy programme operates through government channels and is large enough, it may prevent the emergence of a private fertiliser distribution and retail industry. Some authors have also argued that subsidy programmes may crowd-out the private sector through lowering the market price of unsubsidised inputs through leaked subsidised inputs being resold (Takeshima et al., 2012).

In the input subsidy literature, the terms crowding-out and displacement have been used synonymously. However, an important contrast may be made between the two terms. While crowding-out is generally taken to refer to the potential negative effect a policy may have on private sector activity, in the case where the private sector is used to sell subsidised inputs, then even if the receipt of a subsidised input takes the place of an unsubsidised input that would have been purchased anyway, this might be better termed a displacement effect. The reason being that those retailers involved in selling subsidised inputs would not actually suffer from a crowding-out effect. They may even benefit from temporary or longer increases in demand, in which case it would represent a case of crowding-in.¹² Also, a distinction could then be made then with potential crowding-out of sales among any private sector actors that were *not* involved in selling subsidised inputs and lost sales as a result.

A second distinction between crowding-out and displacement could also usefully be made in terms of the effect a subsidy has on individual consumer preferences, and would depend on the period over which any such effects were being observed. If the receipt of a subsidised input simply causes someone to purchase the subsidised input (from a commercial retailer) over an unsubsidised input in the short-term, but does not affect

¹² Though there would of course be an opportunity cost of subsidies reaching individuals who would have purchased the products anyway in the absence of the subsidy.

longer-term choices, this might be better deemed a displacement effect. By contrast, if the receipt of a subsidy leads to longer-term changes in an individual's willingness to purchase future unsubsidised inputs, this would be better deemed crowding-out.

These nuances have so far not been made in the recent agricultural input subsidy literature.

3.2.1.2 How are the concepts viewed and conceptualised in health?

Within the PHPS literature, crowding-out and crowding-in have received somewhat less attention overall and the distinction between displacement and crowding-out is, again, not explicitly made. However, similar arguments to those in the AIS literature have been put forward recently about the potential for PHPSs to help stimulate or pump prime the commercial provision of PHPs through encouraging a culture of use for a product thereby demonstrating the commercial viability of trading in the products (Roll Back Malaria, 2005). At the individual level, Dupas (2010) puts forward a similar argument to that by Xu et al. (2009) and Takeshima et al. (2012) in the AIS literature regarding crowding-in, which is that subsidising PHPs may help increase longer-term uptake through allowing for experimentation and for users to recognise the benefits or dispel unfounded expectations, such as costs or negative side-effects. In addition, Dupas argues that crowding-in may take place via social learning effects, among those who were not even direct beneficiaries.

In terms of crowding-out, as in agriculture, there is at least some awareness in theory that targeting those who would already buy subsidised inputs may crowd-out commercial sales (Hanson et al., 2001, Roll Back Malaria, 2005). In addition, Dupas (2010) notes that those receiving subsidised PHPs may in theory be less likely to purchase commercial equivalents in future due to reference-dependence, i.e. anchoring around the subsidised price and not wishing to pay more later. A further crowding-out mechanism suggested in the PHPS literature is argued to operate through a large increase in aggregate demand for a PHP brought about by a subsidy resulting in retailers raising commercial prices, thereby lowering purchases of the same unsubsidised PHPs among those without a subsidy (Gingrich et al., 2011a). However, this appears to be predicated upon the assumption that supply remains fixed, as otherwise standard neoclassical theory suggests that suppliers should respond to an increase in demand by increasing supply, thereby bringing prices back down in the medium-term.

3.2.2 What is the state of evidence and what methods have been used?

3.2.2.1 Health

Hanson et al. (2001: 130) noted some time ago that ‘Very little empirical research has considered the impact of subsidised services on the use of commercially priced sources’ and that ‘The limited evidence that exists tends to be descriptive and does not allow for firm conclusions.’ Around the same time, Mills et al. (2002) also highlighted a similar gap in the evidence base relating to social marketing programmes. In the context of the growing subsidies on ITNs, it has been noted that there is an urgent need for research into the extent to which crowding-out is a problem given the potentially negative effect on the commercial market (Roll Back Malaria, 2005). However, since then relatively little appears to have changed, with few examples of rigorous empirical studies. Part of the reason for this may be that in the case of health there appears to be a clear tension between the goal of bringing about rapid gains in access and laying the foundations for longer-term sustainable access. While there has been a considerable focus on the former, less attention appears to have been given to the latter (Hanson et al., 2001: 129).

The main area where some studies have started to emerge concerns ITNs, reflecting their growing popularity since the turn of the century. However, very few have looked at impacts of subsidised ITNs on unsubsidised sales. One study has used a partial equilibrium model to estimate the impact of Tanzania’s ITN voucher scheme (the TNVS) on total ITN coverage in the wider economy (Gingrich et al., 2011a). While described in more detail later, in brief the TNVS has involved the distribution of vouchers to pregnant women and mothers of young children, entitling them to a fixed discount on an ITN at accredited outlets, with the remaining cost covered by the recipient. The fixed discount changed to a fixed price from 2009 to limit the effect of future price increases. In the partial equilibrium study the authors looked at the impact of the TNVS on total ITN coverage by estimating price elasticities of demand based on household survey data from 2006 and used these estimates with an assumption of homogenous demand preferences to simulate ITN purchases under different scenarios with the subsidy vouchers worth different amounts. The authors estimated that while the TNVS increased overall purchases by around 170,000 nets compared to a counterfactual without the programme, the increased demand for nets through the subsidy led to a higher price for unsubsidised nets, causing a decline in the number of ‘non-target households’ purchasing a net from 1.1 million to 769,810. However, while wholesale prices did increase, there are other

potential explanations for this, such as inflation and rising oil prices from 2007. A further problem of using the partial equilibrium approach is that it does not consider the effects of crowding-out that may arise through displacement of unsubsidised sales by subsidies reaching those who would have bought nets anyway. The study does also estimate a demand model explaining the purchase of ITNs, but includes the receipt of free nets rather than partially subsidised TNVS nets as a covariate. It finds the receipt of a free net within 36 months of the survey being strongly negatively associated with the probability of future purchase of ITNs ($p < 0.01$), indicating crowding-out.

The other study that has looked at the impact of subsidised nets on unsubsidised sales looked at the impact of fully subsidised nets and also on reported WTP rather than actual purchases (Chase et al., 2009). Using a Tobit model, the authors found ownership of a free net to be statistically associated with decreasing demand for unsubsidised nets ($p < 0.10$).

Other related studies have looked instead at the impacts of subsidised nets on subsidised purchases. One experimental study in Kenya found that subsidies on LLINs may crowd-in future purchases through experience and social learning effects (Dupas, 2010). This was done by comparing reported and observed WTP for nets among households who received different levels of subsidy. However, while there was some evidence of higher WTP in a number of groups who received the higher subsidy, the observed WTP was for another subsidised net, in some cases even more highly subsidised than the first net received, meaning it does not tell us directly about impacts on unsubsidised future purchases.

More recently, there have been a number of studies starting to look at the impact of fully subsidised nets on demand for partially subsidised nets in Tanzania (Eze et al., 2014, Gingrich et al., 2011b, Gingrich et al., 2014). While two studies found no evidence of free net campaigns reducing demand, the 2014 study by Gingrich et al. did find a substantial immediate reduction in the number of subsidised nets being sold compared to predicted sales following the free net campaign by around 34%, rising to 57% after six months.

3.2.2.2 Agriculture

In contrast to the health literature there have been more attempts in agriculture at estimating crowding-in and crowding-out effects on unsubsidised sales. Part of the reason

for this is that the private sector in agriculture has for some decades now been considered within mainstream economic thinking to be the ideal long-term source of access to inputs and, therefore, something to be nurtured and supported.

All of the studies make use of demand model estimation using household survey data and various non-linear econometric estimation methods, following on from Xu et al. (2009). In general terms, the models estimate demand for commercial inputs, including an explanatory variable that represents ownership of, or access to, subsidised inputs. Controlling for various other explanatory factors, the coefficient on this variable is then taken as the basis for estimating the level of crowding-in or crowding-out.

A number of authors have used double hurdle models to study fertiliser subsidy programmes in Zambia (Xu et al., 2009), Malawi (Ricker-Gilbert et al., 2011) and Nigeria (Liverpool-Tassie, 2012). The study from Zambia found that while there was statistically significant crowding-out of commercial sales overall and especially in areas of high private sector activity, crowding-in also appeared to take place where the private sector was less developed and when subsidies were targeted towards poorer households.

In the case of the Malawi study, there was only evidence of statistically significant crowding-out. On average, an additional kilogram of subsidised fertiliser was found to be associated with the crowding-out of 0.22kg of unsubsidised fertiliser, ranging from 0.18kg among the poorest farmers to 0.30kg among the wealthiest.

In the case of Nigeria, results from the double hurdle model suggest that while receiving subsidised fertiliser did not increase the probability of participating in the private fertiliser market, it did increase the quantity of fertiliser purchased once the decision to participate had been made. Every subsidised bag was associated with an increase of 0.8 bags ($p < 0.01$).

A further study by Takeshima et al. (2012) on Nigeria adopted the same conceptual framework as the others but used endogenous Tobit models, treating commercial fertiliser prices as endogenous as they believed that subsidised fertiliser led to reductions in the market price of unsubsidised fertiliser due to leaked fertiliser being resold. As such, they went on to argue that the depression of open market prices may have led to crowding-out of the private sector (unless private retailers can reduce procurement costs per unit and make a profit selling at lower prices, which they argue is unlikely as not many private

dealers have access to leaked subsidised fertiliser).¹³ The authors also only used single-source users (i.e. those who either bought from an unsubsidised source or subsidised source) and so rather than using observed subsidised fertiliser to measure crowding-out they proxied it for expected subsidised fertiliser quantity. Overall, they found that a kilogram of subsidised fertiliser reduced demand for unsubsidised fertiliser by between 0.19 and 0.35kg.

More recently a number of authors have extended the framework to try and account for evidence of diversion of subsidised fertiliser at the wholesale level, which is subsequently resold (Jayne et al., 2013, Mason and Jayne, 2013). By accounting for diversion, they find that estimates of the impact on incremental use decline. Despite an error in the algebra altering their estimates (Dorward and Chirwa, 2014), the general findings still hold and suggest that knowledge of the level of leakage occurring is crucial to ensuring more accurate estimates of the impact subsidy programmes have on raising incremental use of the products being subsidised.

The review of both AIS and PHPS literatures reveals a number of insights. Of relevance here for the purpose of developing the thesis objectives are the following. First, despite an awareness of the potential role of PHPSs in pump-priming private input markets, it seems that there remains a gap in the empirical literature when it comes to looking at the effect PHPSs have on unsubsidised sales. This is an important omission as it means that we currently know fairly little about the actual effect of PHPSs in terms of overall incremental use. Second, the studies from the AIS literature suggest an alternative method to the partial equilibrium model used by Gingrich et al. (2011a) for estimating the impact of a PHPS programme such as the TNVS on incremental sales. Crucially, such an approach would allow for investigation of the effect a PHPS programme has on household level demand for equivalent unsubsidised PHPSs.

The TNVS emerges as an obvious case through which to study these effects. Firstly, the programme is of a sufficiently large scale to reasonably expect some crowding-in or crowding-out effects. It is also one of the first countries in SSA to have achieved universal coverage with a LLIN for every two people and one of the few that demonstrates such a strong private sector network selling mosquito nets (NATNETS, 2012). For this reason it provides an interesting case study. The TNVS also benefits from a number of large

¹³ This provides an interesting contrast to the view by Gingrich et al. (2011a) that a subsidy may instead lead to increased market prices due to increased aggregate demand, thereby crowding-out from another direction.

household level datasets containing the information required. Finally, the findings may then be compared and contrasted with the existing studies on the TNVS mentioned earlier.

3.3 Research objectives

Based on the foregoing review, the remainder of the thesis is aimed towards answering the following research objectives:

1. To explore socioeconomic-related inequalities relating to coupon allocation, coupon redemption, and use of subsidised inputs in the Malawi FISP between 2006/07 and 2012/13.
2. To identify and assess the importance of different factors that determined the allocation and redemption of subsidy coupons in the FISP and use of subsidised inputs among smallholder households.
3. To estimate the impact that the TNVS had on commercial ITN sales and overall ITN coverage between 2005 and 2008.
4. To assess policy implications arising from the empirical findings for the design and implementation of AIS and PHPS programmes.

Chapters four, five and six address the first three objectives respectively, each being based upon separate research papers. Objective four is partly addressed within each of the discussion sections of these chapters and more fully elaborated in the final overall discussion chapter, where there will be some overlap with previous results and discussion sections.

Preamble to research paper one

The following chapter presents a quantitative research paper investigating research objective one of the thesis, *to explore socioeconomic-related inequalities relating to coupon allocation, coupon redemption, and use of subsidised inputs in the Malawi FISP between 2006/07 and 2012/13.*

Using three rounds of household survey data (2006/07, 2008/09 and 2012/13) the paper applies methods drawn from the literature on PHPSs in order to investigate the extent of socioeconomic-related inequality in the transmission of fertiliser subsidies to beneficiaries in Malawi's FISP.

The chapter is adapted from an article being submitted to Agricultural Economics. Luke Harman designed the study, analysed the data and drafted the paper. Professor Andrew Dorward and Dr Catherine Goodman provided advice and support throughout the research process, including comments at the drafting stage.

4 Measuring targeting outcomes in Malawi's Farm Input Subsidy Programme: an application of concentration curves and concentration indices

Abstract

Malawi's Farm Input Subsidy Programme (FISP) has attracted much attention after being credited by some with engineering an agricultural-led boom and reversing the country's chronic food insecurity, and criticism from others as an ineffective and wasteful use of government resources. A critical issue for the programme's effectiveness concerns the extent of access to subsidies by intended beneficiaries. While various studies have estimated targeting outcomes, they have typically relied on coefficients from particular subsidy participation equations, providing a limited insight into how outcomes may vary across the full sample of households. This paper applies concentration curves (CCs) and concentration indices (CIs), previously unused within the agricultural input subsidy literature, offering new insights into the socioeconomic-related inequality of targeting outcomes. The study also updates earlier studies by drawing on the 2012/13 household survey, allowing for comparisons over time, and looks at a variety of targeting outcomes from coupon receipt to input use. Results suggest that, while there have been improvements (e.g. CIs for the volume of fertiliser received declined from 0.12 to 0.06 between 2006/07 and 2012/13), the FISP continues to disproportionately benefit less poor households. The findings question the wisdom of continuing with the current approach of relying on community-based targeting.

4.1 Introduction

The past decade has seen a renaissance in the use of AISs in LMICs, particularly in sub-Saharan Africa (SSA) (Chirwa and Dorward, 2013a). After falling out of favour during the period of structural adjustment in the 1980s, it was increasingly recognised during the 1990s that AISs may be justified in certain situations to address the need for agricultural intensification for poverty reduction and food security (Reardon et al., 1995). More recently, new thinking has gained ground recognising the potential such policies have for helping overcome poverty traps, improving food security, and even supporting broad-based economic growth in poor agricultural economies (Dorward, 2009). While there remain those that are more sceptical of the economic justifications for AISs, they recognise that AISs are here to stay and have sought to provide guidance on how to make them ‘Market-Smart’ (Jayne and Rashid, 2013, Morris et al., 2007).

One notable difference between pre-structural adjustment subsidy policies and the new wave of AIS programs (AISPs) is the greater emphasis now placed on targeting. Part of the reason for this is the need to limit fiscal outlays in the presence of budgetary constraints. Another is the attempt to avoid a number of key criticisms levelled against fertiliser subsidies, including regressive distribution of benefits, crowding-out of the private sector and rent-seeking (Morris et al., 2007). Despite the official move towards targeted AISs, a recent review of evidence from SSA concluded that in three out of the four countries covered, wealthier and more politically connected households appear to capture a higher proportion of the overall subsidy (Ricker-Gilbert et al., 2013a).

This paper revisits the issue of beneficiary level targeting outcomes in Malawi’s Farm Input Subsidy Programme (FISP). Despite a large literature measuring targeting outcomes in the FISP, most studies have been based on data prior to 2009/10, though a number of significant changes have taken place within Malawi and the FISP since 2008/09.¹⁴ Studies to date have also relied heavily upon the use of multivariate regression to estimate particular targeting outcomes, which provide individual coefficients, making it difficult to appreciate how relationships may change over the full distribution of a continuous indicator such as wealth.¹⁵ They also do not explicitly recognise the various

¹⁴ Exceptions are Kilic et al. (2013) and evaluation reports (Dorward and Chirwa, 2011b, Dorward et al., 2013). The re-election of the late President Bingu wa Mutharika in 2009 marked a key turning point in the FISP, with an end to supplementary coupons and the continued advocacy of “open meetings” initiated in the 2008/09 season. From the 2008/09 season there was also a regional shift in coupon allocation away from the northern region (Dorward et al., 2013).

¹⁵ Again, Kilic et al. (2013) is an exception that does use a wider range of methods (see section three of this chapter).

steps involved in the subsidy allocation-use process. Malawi's FISP is an interesting case as not only has it attracted the greatest amount of interest of the recent AISPs, with a large body of evidence against which to compare findings, but the programme is also one of the longest running of the recent AISPs, allowing for analysis over time.

This study draws on methods used in a parallel literature on public health product subsidies, namely concentration curves (CCs) and concentration indices (CIs). CCs offer a richer and more visual depiction of socioeconomic-related inequality associated with targeting, with CIs permitting quantitative comparison over time. The study also adopts a more holistic conceptualisation of the targeting process, analysing a range of targeting outcome indicators in order to compare inequality at each of the three main stages of the subsidy allocation-use process (see section 3). Finally, targeting outcomes are brought up to date by using data from the most recent 2012/13 Farm Input Subsidy Survey (FISS), therefore allowing for comparison of changing outcomes from 2006/07.

The paper finds that despite some improvement since 2006/07, receipt of any fertiliser coupon still occurs disproportionately among households ranked higher on indicators of wealth based on assets and income. Estimated inequality appears to increase according to CCs if you take into account the number of fertiliser coupons acquired. While socioeconomic-related inequality in redemption of coupons for fertiliser is less pronounced, CIs indicate a marginal degree of inequality, and considerable inequalities continue to exist in terms of the amount of subsidised fertiliser acquired. Finally, the CI for 2008/09 provides some evidence to support the hypothesis that poorer recipient households may be slightly more prone to misuse of subsidised fertiliser, though this is contradicted by bivariate summary statistics for the 2012/13 season, urging caution in what conclusions can be drawn.

The findings cast serious doubt over the effectiveness of the current targeting mechanisms being used to target resource-poor households. Drawing on findings from the qualitative work carried in chapter 5, the paper argues that a key part of the problem lies in authority held by village leaders in decision-making relating to beneficiary identification and coupon allocation. The case for a rationed universal subsidy among smallholder farmers is considered along with an alternative proxy means test option.

The next section reviews the theory on who should be targeted by AISs. Section 4.3 then provides a background to Malawi, the FISP and its targeting processes and also reviews the evidence on targeting in the FISP. Section 4.4 presents the methods before presentation of results in section 4.5 followed by a discussion in section 4.6.

4.2 Theoretical background: who should receive input subsidies?

To get a sense of who should receive AISs from an economic perspective it is important to return to one of the underlying economic rationales for input subsidies. As Barker and Hayami noted back in the 1970s, the level of modern inputs used in the production of staple crops may often be much lower than the economically optimal level, defined as the point at which marginal value of production (MVP) equals marginal factor costs (MFC) (Barker and Hayami, 1976). Reasons for this include low awareness of the benefits of inputs, risk-aversion, and profitability and affordability constraints due to a high input-output price ratio and lack of access to cash or credit (Barker and Hayami, 1976, Dorward, 2009, Lele, 1990). Therefore, in the context of poor subsistence-based economies with high input costs and limited access to cash or credit, large numbers of poor farmers may not apply economically optimal levels of fertiliser or other inputs. In turn, with problems of low soil fertility, declining land size per household and a rapidly growing population, in countries such as Malawi, households are likely to produce insufficient food and have limited options for income generation through sales of surplus staples or other crops.

A further reason as to why it may be better to target poorer rather than wealthier households relates to avoiding overuse of inputs. If wealthier households are more likely to use an economically optimal (or near optimal) level of inputs, then reducing the price of inputs through a subsidy could lead to an inefficient over-use among such households, which would not necessarily lead to any further increase in production but may lead to negative environmental impacts.

A further efficiency-based argument for targeting poorer households is that in doing so you are less likely to displace or 'crowd out' unsubsidised purchases that farmers would have otherwise made, with targeting thus more likely to maximise incremental input use and hence the production response and related benefits arising from a subsidy programme (Ricker-Gilbert et al., 2011).

All of the above suggest that there may be efficiency, equity, and household food security reasons as to why AISs should be targeted to poorer households. One potential counter-argument questions the productive efficiency of poorer as compared with wealthier households and it has been suggested that some governments may be inclined to subsidise wealthier larger farmers who may be more likely to produce a surplus, with a view to maximising national staple production to feed urban areas (Burke et al., 2012). Whether or not wealthier households are more productive, the latter point highlights the crucial importance programme objectives play when deciding which farmers to target.

4.3 Background to Malawi and targeting in the FISP

4.3.1 Country background

Malawi is one of the poorest countries in the world. Its Gross National Income (GNI) per capita of US\$ 320 in 2012 was almost half the weighted average of all low-income countries (World Bank, 2012). In 2010, half of the country's population of 14.5 million were below the national poverty line (World Bank, 2012). Malawi's economy is highly dependent upon agriculture, with 85% of the country's population engaged in agricultural activities but with average plot sizes of just 1.4 hectares in 2009/10 (NSO, 2012: 131). Maize is by far the predominant staple crop, grown by almost all agricultural households (NSO, 2005).

While Malawi is thought to have been largely nationally self-sufficient in maize throughout the 1960s and 1970s, often with a surplus to export to the region (Harrigan, 2008), a combination of factors have led to declining per capita aggregate maize availability, until the beginning of the FISP in 2005/06, including but not limited to a continued high dependence on rain-fed agriculture, vulnerability to weather shocks, damaging effects on smallholder farmers arising from the promotion of large-scale (estate) agriculture and a rapidly growing population (Harrigan, 2008: 238, Kydd and Christiansen, 1982). It is also acknowledged by a number of authors that the conditions of the Stabilization and Structural Adjustment Loans implemented during the 1980s were inappropriate and poorly sequenced, with the emphasis on cash crops having a negative effect on the production of maize, and removal of fertiliser subsidies in particular reducing the profitability of maize production (Harrigan, 2003: 849).

4.3.2 Overview of the FISP, targeting criteria and procedures

A large number of AISs have come and gone in Malawi throughout the post-independence period against a backdrop of fluctuating donor support that has taken a number of 'U-turns' (Harrigan, 2003). The most recent – the FISP – started in 2005/06 following severe maize shortages from the previous season. A consistent objective of the FISP has been 'to improve resource-poor smallholder farmers' access to improved agricultural inputs in order to achieve their and national food self-sufficiency and to raise these farmers' incomes through increased food and cash crop production.' (Chirwa and Dorward, 2013a: 89). However, since 2005/06 a number of changes have taken place in the programme's

design as well as the social, political and economic setting, addressed in more detail in Chirwa and Dorward (2013a).

The essence of the programme design has involved targeting approximately 50% of smallholder farmers in the country with a set of vouchers (known as coupons) redeemable for fertiliser and improved maize seed and, from 2007/08, legume seed, at designated outlets after payment of a set top-up fee (see Table 8).¹⁶ While coupon and input sharing between households is discouraged, in practice it is widespread, particularly in the central and southern regions (Dorward et al., 2013).

In 2006/07 and 2007/08 fertiliser was made available through major retailers and two parastatals - the Agricultural Development and Marketing Corporation (ADMARC) and the Smallholder Farmers Fertiliser Revolving Fund of Malawi. However, since 2008/09 it has only been available through the two parastatals. Coupons for maize and legume seeds have been redeemable at a wide range of seed retailers. Evidence from the study in chapter 5 and elsewhere indicates that coupon recipients can face considerable obstacles in accessing subsidised inputs (Mvula et al., 2011).

Targeting in the FISP first involves area-level (district) targeting and then beneficiary level targeting. Formal area targeting criteria have been based around acreage under maize production (and tobacco until 2009/10) - with higher maize producing districts supposed to receive a higher portion of the overall coupons – with increasing attention paid to the number of farm households in different areas from 2007/08. By 2012/13, poverty levels were also supposed to help determine the number of coupons allocated between districts.¹⁷ However, one recent report found that in 2013/14, coupon allocations to the eight districts that were studied appeared to be based more on farm family population rather than poverty incidence (CISANET, 2014), raising questions over how equitable district-level targeting is from a socioeconomic perspective. Independent programme evaluations from 2012/13 and 2013/14 also highlight the same discrepancies (Dorward et al., 2014, Dorward et al., 2013).

¹⁶ Other inputs such as maize storage chemicals and cotton seed have been available at different times but fertiliser, maize and legume seed form the core focus of the programme.

¹⁷ Interview with senior staff member at the MoAFS headquarters, June 2013.

Table 8: Overview of subsidy packages for selected years

	2006/07	2008/09	2012/13
Maize fertiliser packages	One 50kg bag of Nitrogen Phosphorus Potassium (NPK) & one 50kg bag of urea	As per 2006/7	As per 2006/07
Tobacco fertiliser packages	One 50kg bag of D compound & one 50kg bag of Calcium Ammonium Nitrate (CAN)	As per 2006/7	None
Fertiliser coupon allowance for eligible households	One for NPK and one for urea (or one for D compound and one for CAN)	As per 2006/07	As per 2006/07 except coupons for cash crops not available
Fertiliser coupons distributedⁱ	4 million	3.9 million	3.4 million
Top-up price for fertiliser in Malawian Kwacha (MWK)ⁱⁱ	950	800	500
Maize seed packages	2kg hybrid or 3-4kg Open Pollinated Variety (OPV)	2kg hybrid or 4kg OPV	5kg hybrid or 8kg OPV.
Maize coupons distributed	2 million	1.5 million	1.7 million
Top-up price for maize seed (MWK)	None	None	No more than 150MWK, for hybrid only
Maize coupon allowance	One coupon	One coupon	One coupon
Additional packages and allowances	None	1m flexi vouchers for 5kg cotton or unspecified sized packs of beans, pigeon peas, groundnuts or maize. ⁱⁱⁱ One coupon with face value of 680MWK. 200,000 cotton chemical vouchers (face value 50MWK). Maize storage pesticides (no details available).	Legume seed pack containing either 2kg of groundnuts, beans, cowpeas, or pigeon peas, or 3kg of soya beans. No top-up required. Each beneficiary entitled to 200g bottle of maize storage pesticide (100MWK top-up).

Sources: (Dorward et al., 2010, Logistics Unit, 2007, Logistics Unit, 2009, MoAFS, 2012, SOAS et al., 2008). Notes: (i) For 2006/07 to 2008/09 this includes initial and supplementary coupons. (ii) US\$ 1 = 385 MWK as of 10th June 2014 (Oanda.com). (iii) Absence of certified seed in 2008/09 and 2009/10 meant it depended on what was available locally. The number of tobacco packages available until 2008/09 was far smaller than for maize. In 2006/07, however, coupons for maize and tobacco fertiliser were identical and so those allocated for tobacco could be redeemed for maize fertilisers (SOAS et al., 2008).

During the early years of the programme, the average number of fertiliser coupons redeemed per household was considerably higher in the northern region compared to the central and southern regions. This changed from 2008/09, with a drop in coupons issued in the northern and central regions while those in the southern region continued to rise, such that by 2009/10 the number received per household had more or less equalized across the regions (Dorward et al., 2013: 14). Prior to 2009/10 a considerable number of supplementary coupons were also distributed after the initial allocation (around 30% of the initially authorised figure) in a way that has been described as ‘much more opaque as regards systems, criteria, and numbers of coupons distributed’ (Chirwa and Dorward, 2013a: 101). It has been reported that many of the supplementary coupons were allocated disproportionately to the northern region, with evidence to suggest it may have been the result of political influence (Chinsinga and Poulton, 2014). Another study found districts won by the ruling party in the last presidential election received more subsidised maize seed and fertiliser in 2006/07 and 2008/09 (Mason and Ricker-Gilbert, 2012). While area targeting is a crucially important area of study (given that it ultimately determines how many coupons are available within specific villages) this paper focuses on targeting outcomes at the beneficiary level.

From 2006/07 the FISP aimed to target full-time farmers that could not afford one or two bags of unsubsidised fertiliser. By 2008/09 the emphasis was on targeting ‘resource poor’ land-owning households, with an increasing emphasis on vulnerable households, such as those that are female-headed or child-headed, the elderly, guardians of those who are disabled, or people living with HIV/AIDS (Chirwa and Dorward, 2013a: 227).

In 2006/07 a range of different individuals were supposed to be involved in beneficiary selection, including local leaders, Traditional Authorities, VDCs and MoAFS staff. Systems varied between areas. Attempts were made to bring greater accountability in 2008/09 by using a farm household register to help identify beneficiaries and encouraging open community meetings for allocation, led by the MoAFS. In practice, however, evidence from chapter 5 suggests that meetings may often be used to announce who has already been chosen by local leaders.

Since 2009/10, the voter identification numbers of beneficiaries were required to be written next to their names, with the list sent to the MoAFS before being sent back to extension officers who were supposed to distribute coupons to beneficiaries following verification of their voter identification cards (Chirwa and Dorward, 2013a).

4.3.3 Review of evidence on beneficiary targeting in the FISP

A recent review of selected AISP in Africa writes that ‘...the general finding from Malawi is that the most vulnerable households are not sufficiently included in the subsidy program, and that the targeting system does not work particularly well’ (Ricker-Gilbert et al., 2013a). Most evidence on targeting outcomes in the FISP is based on estimated coefficients from subsidy participation equations, in which particular targeting outcomes (e.g. receipt of any coupons or amount of subsidised fertiliser received) are explained by a range of socioeconomic and other factors (Chibwana et al., 2012, Holden and Lunduka, 2010a, Holden and Lunduka, 2010b, Kilic et al., 2013, Ricker-Gilbert and Jayne, 2011, Ricker-Gilbert et al., 2011). Results from these studies generally suggest that the receipt of any coupons and the level of benefit received in terms of the number or value of coupons or amount of subsidised fertiliser, increases with measures of socioeconomic status (SES), such as the value of household assets and land size. There are a few exceptions to this, such as Chibwana et al. (2012) finding a negative association between farm size and receipt of maize seed and Holden and Lunduka finding a negative association between receipt of a fertiliser coupon and value of household assets (2010a) and a positive association between application of subsidised fertiliser and being land poor and a negative association with farm size per capita (2010b). However, these may be due to sample effects, with these three studies drawing on a much smaller sample. Indeed, the main general findings above are supported by bivariate associations reported in the biennial independent evaluations covering 2006/07 to 2012/13 (Dorward and Chirwa, 2011b, Dorward et al., 2013, Dorward et al., 2010, SOAS et al., 2008).

In addition to estimating participation equations, Kilic et al. (2013) also carried out a population-share-based decomposition to calculate two national targeting coefficients for the 2009/10 season; one based on the difference between the share of ‘eligible’ population participating in the programme (coverage) and the share of the ‘non-eligible’ population participating (leakage) and another on the difference between the average value of subsidy among the eligible population and non-eligible population. Three indicators of resource poor eligibility were used: being in the bottom 40% of either annual household per capita consumption expenditure, wealth index values or total landholding. Results suggest that between 52% and 57% of recipients of ‘any coupon’ were non-eligible and the value of subsidy (based on coupons received) acquired by non-eligible households was higher than eligible households when based on a wealth index and total landholding. They conclude that the programme reaches ‘all socioeconomic strata of rural Malawi’

and that ‘If there is any targeting, it is in the middle of the welfare distribution’ (Kilic et al., 2013: 4).

One limitation of the studies above is that outcomes may be dependent upon the choice of outcome indicator used, which could lead to different estimates depending on which stage of the subsidy allocation and use process one focuses on. For example, in the 2012/13 Farm Input Subsidy Survey (FISS) 7.7% of fertiliser coupon holders did not successfully redeem all of their fertiliser coupons (Table 12). This means that receipt of coupons or number of coupons received may not always be a good measure of targeting outcomes. Therefore, what is needed is a more holistic approach to measuring participation in the FISP from receipt of coupons to their redemption and eventual use of subsidised inputs. Within each of these stages, there may also be differences depending on the specific indicator used (e.g. whether it is receipt of any coupon or number of coupons received).

A further limitation of the body of evidence is that most studies focus on targeting outcomes from 2009/10 or before (though the programme evaluations for 2010/11 and 2012/13 use more recent data), although there have subsequently been a number of major changes to programme modalities as well as to the socio-political and economic context in Malawi. There is therefore a need to update our understanding of targeting outcomes using more recent data. This also allows us to look into how targeting outcomes have changed over the years.

Finally, aside from the above study by Kilic et al., the use of alternative methods for estimating targeting outcomes of the FISP or other recent AISPs has been limited, with one known exception being the use of Benefit Incidence Analysis by Osorio et al. (2011) to estimate the share of subsidy captured by those in different wealth categories in Indonesia. While regression analysis is certainly useful for measuring targeting, the individual coefficients it produces do not always provide a clear or intuitive sense of actual targeting outcomes and how they might vary across the full distribution of a particular sample or population.

This paper uses concentration curves and concentration indices (CCs and CIs) to estimate the socioeconomic-related inequality of a range of targeting outcomes in 2006/07, 2008/09 and 2012/13 with a wealth index used to rank households by SES. These methods, explained further below, have been widely used in the health literature on public health product subsidies and other health interventions, e.g. (Dingle et al., 2013, Noor et al., 2007, Webster et al., 2005), but so far have not been used in the AISP literature.

4.4 Methods

4.4.1 Summary of methods

Given the importance attached to achieving pro-poor outcomes in many health interventions, a number of methods are used within the health literature to estimate the socioeconomic-related inequality of health outcomes. These include equity ratios, benefit incidence analysis and - the two methods used in this paper – CCs and CIs.

A CC represents how the cumulative percentage of an outcome (e.g. receipt of a subsidy voucher) (y-axis) is distributed among the cumulative percentage of the population when ranked by some measure of SES, from poorest to richest (x-axis). If the outcome is distributed perfectly equally among all households regardless of their SES, the CC would lie directly on an upwards sloping 45-degree line of perfect equality (see Figure 10).

A CC lying above (below) the 45-degree line indicates the outcome is disproportionately distributed among the poor (rich). A dominance test can then be run to determine whether a particular CC can be said to lie above another, or above or below the 45-degree line, with a degree of statistical confidence. The test is described further below. Given this visual representation of how an outcome changes across the full distribution of a given population, CCs overcome the problems associated with the individual coefficients that are provided by regression estimates, providing a richer, more visual and intuitive insight.

To facilitate comparison across space and time, CIs can be derived from the CCs, with the CI being calculated as ‘twice the area between the concentration curve and the line of equality’ (O'Donnell et al., 2008: 95). Therefore, if the CC lies at every point directly on the line of equality, the CI will be zero. If the CC lies everywhere above (below) the line of equality, the CI takes a negative (positive) value. Given that a CI may also equal zero if a CC crosses the 45-degree line and if the areas above and below cancel each other out, it is important to interpret a CI in combination with its respective CC.

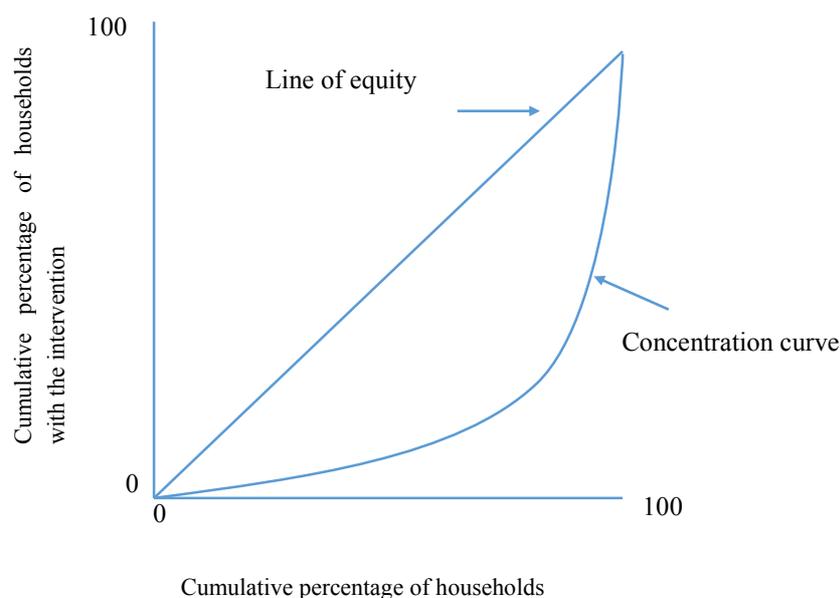


Figure 10: Concentration curve as measure of equity

Source: Adapted from Webster et al. (2005)

4.4.2 Application of concentration curves and concentration indices

CCs, dominance tests and CIs were estimated for the 2006/07, 2008/09 and 2012/13 seasons using Stata 13. The analysis drew on the .ado files *glcurve*, *dominance* and *conindex*.¹⁸ After estimating CCs, dominance tests were carried out at the 5% significance level. Two decision rules were used: the *Multiple Comparison Approach* (MCA) and a more restrictive *Intersection Union Principle* (IUP). Both approaches checked for a statistically significant difference between two curves at 19 quantile points. While MCA will reject the null hypothesis of non-dominance if just one significant difference exists between the curves in one direction (providing there is no significant difference in the other), IUP requires a significant difference between the curves at *all* quantile points (O'Donnell et al., 2008: 88).

To facilitate comparison of inequalities over time, CIs were then calculated. One must be careful of making comparisons across outcome indicators, especially those with different

¹⁸ *Glcurve* and *dominance* are available using the `findit` command. *Conindex* has not yet been released and was developed by Stephen O'Neil, Brendan Walsh, Tom Van Ourti and Owen O'Donnell (National University of Ireland, Galway and Erasmus University Rotterdam).

means, given how the CI is calculated. As per Equation 1, a CI can be defined in terms of the covariance between the outcome variable (o) and the fractional rank in the living standards distribution (r), which is simply $\frac{i}{N}$ where i is the rank of a particular observation within the population N (Kakwani, 1980). The variable μ represents the mean of the outcome variable.

$$CI = \frac{2}{\mu} cov(o, r)$$

Equation 1

As this definition shows, a CI does not depend on any variation in the living standards variable itself, just on the relationship between the outcome indicator and rank in the living standards variable. This means that, providing the rankings remain unchanged, a CI need not change in response to a change in the *degree* of income inequality (O'Donnell et al., 2008).

To calculate the CI, the convenient regression method in Equation 2 was used based on the covariance definition in Equation 1, following Kakwani et al. (1997). Equation 2 was estimated using Ordinary Least Squares (OLS), where σ_r^2 is the variance of the fractional rank, o_i is the outcome variable for the i^{th} observation and μ is the mean of that variable. The estimated β then becomes the CI, α is a constant and ϵ_i are the estimated residuals. Sample weights were applied in calculating the covariance, mean of the outcome variable and fractional rank. Given the likely autocorrelation arising from the ranked explanatory variable, a Newey-West regression was adopted to provide standard errors robust to autocorrelation and heteroscedasticity (O'Donnell et al., 2008).

$$2 \sigma_r^2 \left(\frac{o_i}{\mu} \right) = \alpha + \beta r_i + \epsilon_i$$

Equation 2

One complication in calculating CIs arises when using dichotomous variables. While for continuous variables the CI is bounded between -1 and 1, with dichotomous variables the bounds of the CI depend on the mean of the variable (Erreygers, 2009a, Wagstaff, 2005). This can complicate comparison of CIs for the same outcome across different samples where the means are different.

As described below, some of the outcome variables considered in this study are dichotomous. Where this was the case, the standard CIs were corrected using both Wagstaff's normalisation and Erreyger's correction (see Appendix 6 for further details). Both approaches produced CIs, which ranked outcomes equally over time but demonstrated differences in absolute values, with Wagstaff's normalisation resulting in higher estimates. This may be due to the tendency of Wagstaff's approach to exaggerate the levels of measured inequality for distributions with high or low means (Erreygers, 2009b). As such, only results using Erreyger's correction are presented as the levels produced appear to be most consistent with the CCs and original CIs.

Finally, p-values for z-scores were used to identify whether the CIs were statistically different from zero at the 5% significance level. The *conindex* command was then used to estimate statistical difference between curves for different years, also at the 5% significance level.

4.4.3 Data

The paper draws on three rounds of household survey data from the Agricultural Input Subsidy Surveys (AISSs), later renamed FISSs, gathered as part of an ongoing external evaluation commissioned by the UK's Department for International Development. Interviews were carried out every two years from 2007, covering the previous agricultural season. As the sample size of the household survey for 2010/11 was relatively small and not nationally representative it is excluded from the analysis.¹⁹ Interviews for the 2006/07 and 2008/09 surveys were carried out in May and June with those for the 2012/13 survey in April and May.

The 2006/07 sample consisted of a 3,298 household subsample of the earlier Integrated Household Survey 2, stratified by district and livelihood zone. Within each district, 175 clusters known as Enumeration Areas (EAs) were selected randomly based on probability proportionate to size. Within each EA, 20 households were then randomly selected, with between 16 and 21 households interviewed per EA. The total sample covered what was at the time 26 districts (SOAS et al., 2008: 16). As with all subsequent surveys, only rural households were sampled. The 2008/09 sample was drawn from the 2006/07 survey, though due to a smaller budget, it used a subsample of 60 EAs and 1,982 households.

¹⁹ While the 2009/10 data from the Third Integrated Household Survey (IHS3) could be used to fill the gap, the significant sampling differences with the other surveys used here would themselves likely introduce heterogeneity in the results.

Finally, the 2012/13 survey was not designed as a panel follow-up, though it drew from 13 of the 14 districts included in the 2008/09 AISS, with a similar sample size of 2,001 households. Table 9 provides a summary of each sample, including composition by region. The numbers of households interviewed by district and by livelihood zone are presented in Appendix 8 and Appendix 9 respectively.

Table 9: Summary statistics from households surveys

Dataset	AISS-1	AISS-2	FISS-4
Year of data collection	2007	2009	2013
Reference season for coupon receipt	2006/07	2008/09	2012/13
Households interviewed	3,298	1,982	2,001
<i>Part of previous panelⁱ</i>	<i>2,874</i>	<i>1,546</i>	<i>0</i>
Households by region			
<i>Northern</i>	529 (16%)	380 (19%)	360 (18%)
<i>Central</i>	1161 (35%)	719 (36%)	720 (36%)
<i>Southern</i>	1608 (49%)	883 (45%)	921 (46%)
Total individuals	17,145	10,889	9,530
Average household size			
<i>Mean</i>	5.2	5.5	4.8
<i>Median</i>	5	5	5
<i>Standard deviation</i>	2.4	2.4	2.1
Gender of household head ⁱⁱ			
<i>Male</i>	2,433 (74%)	1,454 (74%)	1,479 (74%)
<i>Female</i>	865 (26%)	521 (26%)	522 (26%)
Highest educational qualification of head ⁱⁱⁱ			
<i>None</i>	N/A	N/A	1,224 (76%)
<i>Primary School Leaving Certificate</i>			198 (12%)
<i>Junior Certificate Examination</i>			114 (7%)
<i>Malawi School Certificate in Education</i>			58 (4%)
<i>Non-University Diploma</i>			11 (1%)
<i>University Diploma/Degree</i>			3 (0.2%)
<i>Other certificates</i>			8 (0.5%)

Source: 2006/07 and 2008/09 AISSs and 2012/13 FISS. Statistics are un-weighted. Notes: (i) Households part of the previous survey. For AISS-1 this means part of the Integrated Household Survey 2. (ii) In AISS-2, seven households with both a male and female head were excluded for this statistic. (iii) No questions were asked regarding education in AISS1 or AISS2 and a number of missing observations exist in FISS4.

4.4.4 Indicator selection

The main measure of SES used to rank households was a wealth index covering the amount of land owned, counts of household assets and livestock, and binary variables for the quality of housing (see Appendix 7). The index was compiled using Principal Components Analysis (PCA) (Filmer and Pritchett, 2001). The inclusion criteria for household assets was that at least 5% of the sample must have reported ownership as any less would not have contributed significantly to the index. The same variables were then used for the 2008/09 and 2012/13 indices. The weights used are taken from the first component of the PCA, which is the linear combination that maximises the variance in the observed indicators (Vyas and Kumaranayake, 2006). The first principal component accounted for approximately 23% of variation across the samples. In a small number of cases where missing values were reported for housing in 2008/09 and 2012/13, the modal housing characteristics for the village were applied.

While the asset index is the preferred indicator, A second and third measure of SES were also used to check that findings were robust to choice of welfare indicator, as choice of indicator has been found to be important in measuring inequality in other work using CCs and CIs (Lindelow, 2006). The measures were total (net) household income and household income per capita. However, reporting of household income is known to suffer from potentially significant measurement error both non-intentional and intentional, and there is some recognition that it is likely to often be underreported (Psacharopoulos, 1997, World Bank, 2010: 67). Therefore the asset index was used as the preferred primary indicator of SES.

A small proportion of sampled households reported not owning any land (3% in 2006/07, 2% in 2008/09, and 6.3% in 2012/13). As according to FISP criteria these households should not be targeted, an argument could be made that they should be excluded from the analysis as if such households were also among the poorest, including these technically ineligible households may overstate the otherwise unfair inequalities. However, landlessness turned out to be evenly distributed across wealth quintiles and removing them made no difference to results and so they were kept in the sample.

A number of outcome indicators were constructed covering each stage of the subsidy allocation-use process in order to investigate the importance of indicator selection (Table 10). The focus on fertiliser and fertiliser coupons was decided on the basis that they represent by far the most financially valuable aspect of the FISP to beneficiaries.

Table 10: Outcome indicators used in estimation of concentration curves and concentration indices

Stage in subsidy allocation-use process	Outcome indicator	Type of variable
Coupon allocation	Receipt of any fertiliser coupon	Dichotomous
	Number of fertiliser coupons received	Count
Access to subsidised inputs	Redemption of all fertiliser coupons received (among coupon recipients)	Dichotomous
	Volume of subsidised fertiliser received (among coupon recipients)	Continuous
Use of subsidised inputs	If no 'other use' was reported for any subsidised fertiliser received (among those who redeemed at least one fertiliser coupon)	Dichotomous

4.5 Results

4.5.1 Summary statistics

Table 11 shows the percentage of households reporting receipt of different numbers of coupons and the average volumes of subsidised fertiliser acquired. One immediate observation is that outcomes are not consistent with MoAFS guidelines that each beneficiary household should receive two fertiliser coupons plus either one maize seed coupon (2006/07) or a maize coupon and additional 'flexi' or legume coupon (2008/09 and 2012/13 respectively). What this indicates, along with the decreasing average number of fertiliser coupons among beneficiary households and the declining average volume of subsidised fertiliser per recipient household, is increased sharing of packages. Given this, we might hypothesise that in so far as there is any socioeconomic-inequality in targeting, it will be better explained by looking at the number of coupons or amount of inputs received rather than the dichotomous variables for the same stages.²⁰ One can also see a peak in fertiliser coupon receipt in 2008/09, demonstrated by the lowest proportion of households reporting receipt of no coupons with only a small fall in the average fertiliser receipt per recipient household.

²⁰ The higher proportion of households reporting receipt of a full package in 2012/13 appears due to the much increased access to seeds as the proportion getting two fertiliser coupons was statistically lower, by around half.

Table 11: Weighted percentage of households by number of coupons received and average quantity of subsidised fertiliser received per household

	AISS1	AISS2	FISS4
	06/07 n=3298	08/09 n=1982	12/13 n=2001
Fertiliser coupons	% [95% CI]	% [95% CI]	% [95% CI]
0	43.8 [40.6, 46.9]	29.3 [25.4, 33.6]	39.4 [35.7, 43.3]
0.5	0	2.3 [1.4, 3.6]	10.2 [7.4, 14.1]
1	26.2 [23.7, 28.9]	35.4 [31.2, 39.8]	32.9 [29.2, 36.8]
2	24.1 [21.5, 26.9]	28.7 [25.0, 32.5]	16.9 [14.2, 19.9]
>2	5.9 [4.8, 7.3]	4.4 [3.3, 5.8]	0.6 [0.3, 1.2]
Average fertiliser coupons			
Mean fertiliser coupons per recipient household	1.8 [1.68, 1.93]	1.6 [1.50, 1.66]	1.2 [1.15, 1.28]
Average fertiliser volume (kilograms)			
Mean fertiliser among recipients	88.4 [84.3, 92.4]	75.58 [71.5, 79.6]	58.2 [54.9, 61.5]
Modal fertiliser among recipients	50	50	50
Seed coupons (maize or legume)			
0	92.6 [91.0, 93.9]	50.2 [46.1, 54.3]	54.4 [50.5, 58.2]
0.5	0	1.0 [0.5, 1.9]	4.5 [3.2, 6.3]
1	6.3 [5.2, 7.7]	43.3 [39.5, 47.2]	17.7 [15.4, 20.1]
2	0.7 [0.4, 1.2]	4.3 [3.4, 5.4]	22.5 [19.7, 25.6]
>2	0.3 [0.1, 0.8]	1.2 [0.5, 2.8]	1.0 [0.6, 1.6]
Full coupon package			
Percentage receiving full package (or more)	4.1 [3.1, 5.3]	0.6 [0.2, 1.4]	11.9 [10.1, 14.3]

Source: AISS and FISS datasets. Notes: Confidence intervals in square brackets. Estimates account for household weights and stratification based on sample design. Fractions of coupons have been rounded up to the nearest half coupon such that 0.3 of a coupon becomes 0.5 and 0.8 becomes 1

Given the various stages involved in the targeting process, it is also useful to get a sense of any attrition that might be taking place. Table 12 looks at this issue by showing the weighted percentage of households in 2012/13 reporting receipt of any fertiliser coupon, successful redemption of all fertiliser coupons, and whether any ‘other uses’ of the subsidised fertiliser were reported. It also looks at the bivariate relationship between these outcomes, SES and demographic factors. Results for other years can be found in Appendix 10 and Appendix 11.

Results from Table 12 suggest that approximately two thirds of households in 2012/13 received at least some share of a fertiliser coupon, though 7.7% of these households did not redeem all of the fertiliser coupons received. If multiplied by the estimated number of farm households in Malawi receiving any subsidised fertiliser, this suggests that around 135,786 households may not have redeemed all fertiliser coupons. This compares to a much lower 59,859 in 2006/07 and 60,731 in 2008/09, largely due to the lower reported levels of non-redemption.²¹ It is possible that non-redemption may also be underestimated in cases where fertiliser coupons were sold, given that sale of coupons is illegal and a highly sensitive topic (Holden and Lunduka, 2012b). The main reported reason for non-redemption of fertiliser coupons in 2012/13 was overwhelmingly that there was no stock in the selling point (68% of non-redeemed fertiliser coupons).

The large majority of subsidised fertiliser acquired was reported to have been mainly used on the household’s own land, with 4.3% reporting other uses, mostly sharing. However, from what we know about how coupon packages are split and how numbers of coupons are reported, it appears that survey responses to reported fertiliser use will not account for this initial splitting of coupon packages and can generally be considered as indicating what the household did with inputs *after* initial sharing has been taken into account. As with coupon redemption, reported use may diverge from actual use and underreport re-selling given the sensitivity of the issue.

As the total allocation of coupons per household was roughly equal across regions by 2012/13 (Dorward et al., 2013), the lower percentage of reported receipt of any fertiliser coupons in the northern region ($p=0.08$) highlights the lower levels of sharing taking place there, relative to the central and southern regions.

²¹ This is calculated as the proportion of the Malawian smallholder household population receiving any fertiliser coupon based on the FISS household surveys and NSO population estimates, which are then multiplied by the proportion of households reporting non-redemption of all fertiliser coupons (NSO, 2008)

Of particular relevance for this study, results for receipt of fertiliser coupons by SES in Table 12 show that a higher proportion of households in the wealthiest category received at least a share of a fertiliser voucher compared to those in the poorest ($p=0.01$). The difference between the poorest and those in the second and third wealthiest categories was also highly significant ($p=0.03$). We might therefore expect inequalities in the CCs and CIs relating to fertiliser coupons in 2012/13.

Regarding use of all fertiliser coupons (among those receiving coupons), there was no statistical difference between those in the poorest and wealthiest quintile, even at the 10% significance level. Concerning subsidised fertiliser use (among those using coupons), those in the poorest quintile were statistically less likely to report other uses of subsidised fertiliser in 2012/13 than those in the wealthiest quintile ($p=0.04$) with no difference between the poorest and second wealthiest. However, the proportions of ‘other uses’ were very small, the main one being ‘shared with others’ (2.7% of all fertiliser coupons redeemed) and it is not entirely clear how reliable responses on coupon use or input use are.

4.5.2 Concentration curves, dominance tests, and concentration indices

This section presents the CCs, dominance tests and CIs for each of the outcome indicators in Table 10, with households ranked according to the wealth index. Results using household income are provided in Appendix 12.

4.5.2.1 Fertiliser coupon receipt

Figure 11 and Figure 12 show that while there was some improvement after 2006/07, by 2012/13 wealthier households continued to benefit disproportionately from the receipt of fertiliser coupons. However, while the inequality associated with the receipt of *any* fertiliser coupon became very minimal, inequalities in the *number* of fertiliser coupons received appears considerably higher according to the CCs (it is not possible to compare absolute values of CIs across different outcomes). The findings are reflected in the dominance tests in Table 13 and inspection of CIs in Table 14. The dominance tests show that the CC for 2012/13 dominates (i.e. lies above and indicates less inequality than) the 2006/07 curve for the number of fertiliser coupons received, even when using the more restrictive IUP criteria. CIs decrease over time, from 0.20 to 0.08 for receipt of any fertiliser coupon and 0.19 to 0.09 for the number of fertiliser coupons received.

Table 12: Attrition and its relationship to wealth during the subsidy allocation-use process (2012/13)

	Received any fertiliser voucher		Successful use of all fertiliser vouchers (among those receiving coupons)		No reported 'other use' for any subsidised fertiliser (among those using coupons)	
	% [95% CI]	N	% [95% CI]	N	% [95% CI]	N
All households	60.6 [56.7, 64.3]	2001	92.3 [87.8, 95.2]	1162	95.7 [93.3, 97.2]	1105
Quintile 1 (poorest)	53.2 [46.5, 59.7]	400	88.7 [80.1, 93.8]	211	97.9 [93.9, 99.3]	193
Quintile 2	60.6 [53.9, 67.0]	400	94.1 [87.2, 97.4]	227	94.4 [89.5, 97.1]	217
Quintile 3	61.8 [55.6, 67.5]	400	92.9 [86.2, 96.4]	236	94.0 [87.8, 97.2]	226
Quintile 4	64.0 [57.0, 70.5]	400	92.4 [86.6, 95.9]	242	98.8 [96.1, 99.7]	234
Quintile 5 (wealthiest)	64.2 [57.7, 70.3]	400	93.3 [85.6, 97.0]	245	93.3 [88.0, 96.4]	234
Male-headed	59.6 [55.2, 63.7]	1479	92.0 [87.3, 95.1]	845	95.6 [92.9, 97.4]	804
Female-headed	63.5 [58.7, 68.1]	522	93.0 [86.3, 96.6]	317	95.8 [92.3, 97.7]	301
Household size						
1-3	54.5 [48.7, 60.1]	600	90.7 [83.3, 95.0]	311	96.3 [93.4, 98.0]	293
4-6	63.2 [59.4, 66.9]	1009	93.3 [89.6, 95.7]	608	95.4 [92.0, 97.4]	581
>6	63.8 [56.9, 70.2]	392	91.9 [83.9, 96.2]	243	95.4 [91.5, 97.5]	231
Land size						
Up to 0.499 ha	59.5 [52.5, 66.0]	354	95.0 [88.6, 97.9]	204	95.9 [90.4, 98.3]	198
0.5 to 0.99 ha	62.9 [58.1, 67.4]	572	92.9 [88.0, 95.9]	340	97.1 [94.2, 98.6]	323
1 to 1.99 ha	59.9 [54.6, 65.1]	654	91.3 [85.9, 94.8]	380	95.2 [91.2, 97.4]	357
2 ha and above	59.3 [52.1, 66.2]	421	90.5 [83.6, 94.6]	238	94.1 [90.1, 96.6]	227
No livestock	56.2 [50.8, 61.6]	592	91.8 [86.6, 95.1]	320	96.1 [92.7, 98.0]	300
Own livestock	62.5 [58.3, 66.6]	1408	92.5 [87.6, 95.6]	839	95.5 [92.6, 97.3]	802
Northern	51.7 [41.5, 61.8]	360	99.7 [97.5, 100.0]	192	82.1 [66.6, 91.3]	191
Central	61.3 [54.5, 67.7]	720	87.9 [79.9, 93.0]	428	97.3 [94.4, 98.8]	388
Southern	62.0 [57.1, 66.7]	921	95.1 [88.9, 98.0]	542	97.0 [93.4, 98.7]	526

Source: AISS 2006/07 and 2008/09 and FISS (2012/13) datasets.

The shape of the CCs for number of coupons received suggests that the very poorest are receiving far from a perfectly equal share (even though there should actually be a pro-poor bias) as the curves move away from the 45-degree line quite quickly as you move rightwards across the horizontal axis. The sharp return to the 45-degree line at the upper end of the wealth scale for ‘receipt of any fertiliser coupon’, particularly in 2012/13, indicates the very wealthiest were not disproportionately benefitting, with the CCs for number of coupons indicating instead that it was those in the middle wealth categories that were.

When households are ranked by household income the results remain similar except that the 2012/13 curve just crosses the line of equality for receipt of any fertiliser coupon, suggesting a marginally more pro-poor distribution than indicated by the wealth index. When using income per capita, receipt of any fertiliser coupon becomes most pro-poor, at -0.05 ($p=0.05$), though any pro-poor bias is lost when you look at the number of fertiliser coupons, with the distributions for all years being pro-wealthy, though slightly less so than when using the wealth index (Appendix 12).

4.5.2.2 Redemption of fertiliser coupons and purchase of subsidised fertiliser

The second set of indicators looked at redemption of fertiliser coupons (among those who received any fertiliser coupon) and access to subsidised fertiliser (among those that acquired some amount of subsidised fertiliser).²²

The CCs for any coupon redemption show distributions that essentially lie on the 45-degree line and so are not presented here. This suggests that, among those that acquired fertiliser coupons, there is no clear SES-related inequality in redemption of all coupons. The lack of any visible wealth-related inequality fits with the earlier bivariate results for 2012/13 (Table 12) of no statistical difference between wealth quintiles in terms of fertiliser coupon redemption. Dominance tests suggest no statistical difference between the years. However, looking at the CIs we can see some slight pro-wealth inequality not visible in the CCs, declining from 0.04 to 0.02 between 2006/07 and 2008/09. By 2012/13 it was not statistically different from a CI of zero. This suggests the redemption of all fertiliser coupons tended to slightly favour wealthier households in earlier years, though

²² Receipt of fertiliser coupons and receipt of subsidised fertiliser were recorded in separate modules of the household survey that were not linked.

by 2012/13 successful redemption largely cut across SES. There is almost no difference when using household income indicators.

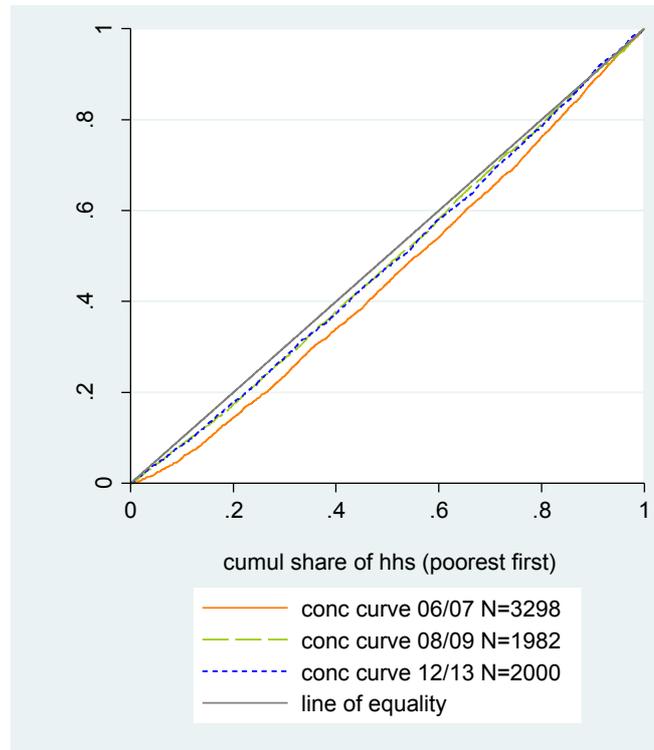


Figure 11: Concentration curve for receipt of any fertiliser coupon

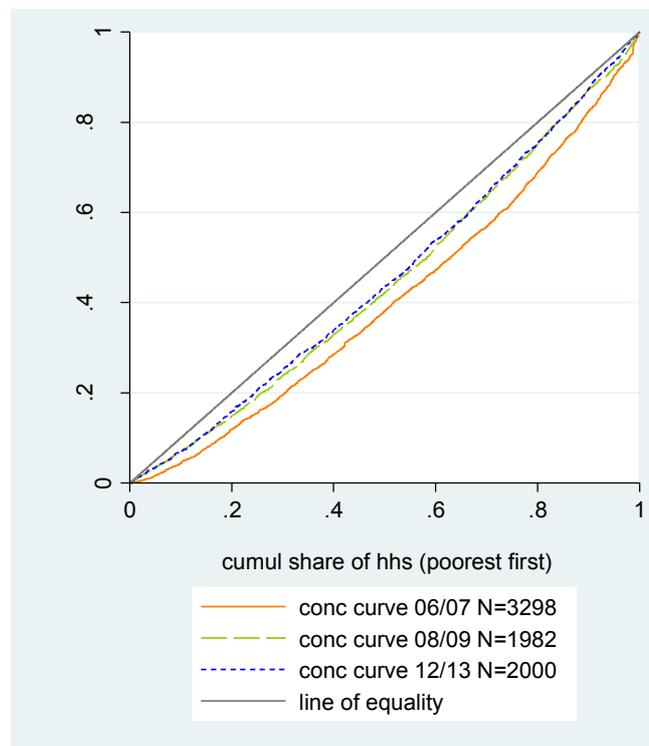


Figure 12: Concentration curve for number of fertiliser coupons received

Higher levels of inequality are picked up when using the volume of subsidised fertiliser acquired as the outcome indicator. This is to be expected, as it is simply a function of the number of coupons received, which was found to exhibit notable inequalities, and the redemption per coupon received. Closer inspection of the CCs for this outcome indicator (Figure 13) indicates that the main inequalities are arising due to households in the upper-middle wealth categories gaining particularly disproportionately.²³ One can also observe a very marginal improvement in inequality over time, though dominance tests suggest no statistical change over the years. CIs show this decline more clearly, from 0.12 in 2006/07 to a still statistically positive 0.06 by 2012/13 (Table 14).

When income is used to rank households, the SES-related inequalities are again less pronounced than when using the wealth index, though do not become negative and remain statistically different from zero (Appendix 12). This reinforces the notion that subsidised fertiliser still accrues disproportionately among wealthier households, despite targeting objectives aiming for a pro-poor bias.

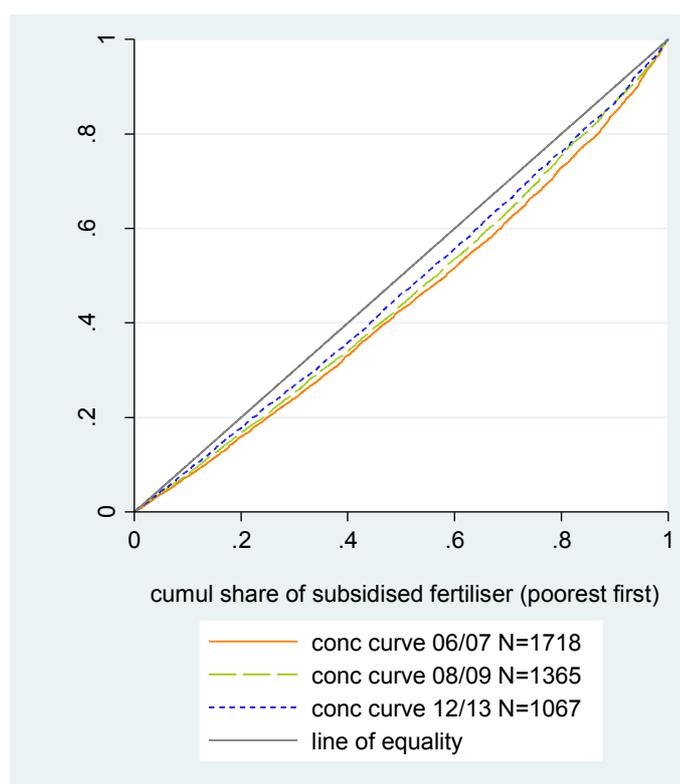


Figure 13: Concentration curve for kilograms of subsidised fertiliser acquired

²³ It is important to note that this does not take into account those benefitting from subsidised fertiliser that is leaked either upstream (before it reaches the local depots) or once it arrives at the depots where evidence indicates it can be captured by vendors who re-sell it through secondary markets (see chapter 5).

4.5.2.3 Use of subsidised fertiliser

The final outcome indicator looked at whether, among households reporting successful redemption of a fertiliser coupon, there was any reported ‘other use’ of the fertiliser acquired besides being applied to the household’s own land. It should be remembered from Table 12 that numbers formally reporting such other uses were small, which may make identification of any inequalities difficult to identify if present.

The CCs do not pick up any clear SES-related inequality. Curves for all years lie more or less directly on the 45-degree line and so are not presented here. However, dominance testing indicates dominance of the curve for 2012/13 over 2008/09. CIs show a shift from 0.01 in 2006/07 to 0.07 in 2008/09, then dropping to -0.02 by 2012/13, with neither the index in 2006/07 nor 2012/13 being statistically different from zero. This suggests reported other uses were disproportionately concentrated among poorer households in 2008/09 but were equal across wealth categories in other years. When ranking households by income, CIs for 2008/09 were not statistically different from zero.

Table 13: Dominance tests for all outcome indicators

Years	Criteria	Outcome indicator				
		Receipt of any fertiliser coupon	Number of fertiliser coupons	Redemption of all fertiliser coupons	Volume of subsidised fertiliser acquired	No reported ‘other use’ of any subsidised fertiliser
2006/07 & 2008/09	MCA	2008/09 dominates				
	IUP					
2006/07 & 2012/13	MCA	2012/13 dominates	2012/13 dominates			
	IUP		2012/13 dominates			
2008/09 & 2012/13	MCA					2012/13 dominates
	IUP					

Source: Author’s analysis. Note: Empty box implies non-dominance. Results are significant at the 5% significance level.

Table 14: Concentration indices using wealth index ranking

Stage	Outcome indicator	Year	N	Concentration index [95% Confidence Intervals]	Z-test for difference with previous year
1	<i>Receipt of any fertiliser coupon (D)</i>	2006/07	3298	0.20* [0.18, 0.22]	
		2008/09	1982	0.09* [0.06, 0.11]	p=0.00
		2012/13	2000	0.08* [0.05, 0.10]	p=0.82
	<i>Number of fertiliser coupons</i>	2006/07	3298	0.19* [0.15, 0.22]	
		2008/09	1982	0.10* [0.08, 0.13]	p= 0.00
		2012/13	2000	0.09* [0.06, 0.12]	p=0.38
2	<i>Redeemed all fertiliser coupons (D)</i>	2006/07	1817	0.04* [0.03, 0.04]	
		2008/09	1386	0.03* [0.02, 0.04]	p=0.59
		2012/13	1161	0.02 [0.01, 0.03]	p=0.70
	<i>Volume of subsidised fertiliser acquired</i>	2006/07	1718	0.12* [0.09, 0.14]	
		2008/09	1365	0.09* [0.07, 0.11]	p=0.02
		2012/13	1067	0.06* [0.04, 0.08]	p=0.02
3	<i>No 'other use' of subsidised fertiliser (D)</i>	2006/07	1760	0.01 [0.00, 0.02]	
		2008/09	1360	0.07* [0.06, 0.08]	p=0.00
		2012/13	1104	-0.02 [-0.02, -0.01]	p=0.00

Source: Author's analysis. Note: For the dichotomous outcome indicators (D), Erreygers' correction is used to standardise them. *Indicates concentration indices were statistically different from zero at the 5% significance level. The null hypothesis of the z-test for statistical difference between years is that there is no difference and so a p-value less than 0.05 indicates a statistically significant difference at the 5% significance level.

4.6 Discussion

4.6.1 What do the results say and how do they fit with existing evidence?

A number of important conclusions can be drawn from the results. Firstly, results show that although there has been some reduction in the socioeconomic-related inequality in the targeting of fertiliser coupons and access to subsidised fertiliser since the start of the FISP, as of 2012/13 both coupons and fertiliser were still disproportionately captured by less poor households. The number of coupons accessed (and in turn the amount of subsidised fertiliser acquired) represents a major problem in terms of the FISP reinforcing existing socioeconomic-related inequalities, with wealthier households better able to capture a larger number of coupons, which translates into them acquiring a larger volume of subsidised fertiliser.

Closer inspection of the CCs for coupon and fertiliser receipt in 2012/13 suggest that while receipt of any fertiliser coupon is fairly evenly distributed by wealth, it is those in the middle of the wealth distribution that benefit disproportionately from a higher number of fertiliser coupons and those in the upper-middle who benefit disproportionately from access to subsidised fertiliser. The lower inequality in access to any coupons indicates sharing processes in which a wide cross-section of households acquire something, though wealthier households end up gaining more coupons (Dorward et al., 2013). This is supported by the findings in chapter 5. While these inequalities are most pronounced when households are ranked according to the wealth index, the general findings are robust to the use of alternative income-based indicators. The slightly lower levels of inequality in income-based indicators may be explained by the recognised phenomenon of underreporting of income in household surveys, which we might reasonably assume would have a greater proportionate impact on those households with higher income (Psacharopoulos, 1997, World Bank, 2010: 67).

The above conclusions raise serious questions about the wisdom of spending considerable time and resources on a coupon and community-based targeting system, which continues to produce outcomes not only at such odds with the FISP targeting aims, but worse than what would be achieved by an equal distribution across income categories.

The improvement from 2006/07 could reflect a large number of factors, though it is difficult to isolate one in particular. For example, 2006/07 was a year with an extremely high number of supplementary coupons that were distributed through opaque processes and so it is understandable that wealthier and more politically connected households may have been better able to benefit from the FISP. However, there have also been changes to

targeting criteria and allocation mechanisms, as well as shifts in the regional distribution of coupons.

The results on access to coupons and subsidised fertiliser are broadly consistent with the existing evidence mentioned in section 3 and suggest that relatively little had changed by 2012/13 since Kilic et al. (2013) looked at outcomes using 2009/10 data and found that the FISP was not particularly poverty targeted, reaching all socioeconomic strata of rural Malawi.

The results on coupon redemption show that, to a limited extent, the redemption process itself favoured wealthier households in 2006/07 and 2008/09, which fits with existing evidence (Mvula et al., 2011). However, by 2012/13 the data do not show a statistical difference by wealth, which may represent the fact that some of the major obstacles to redemption can cut across SES. A further important point relating to coupon redemption emerges from the bivariate analysis in Table 12, which is that approximately 135,786 households appear to have not redeemed all of their fertiliser coupons in 2012/13, the main given reason for which was lack of stock in the depots. Estimates for 2006/07 and 2008/09 were 59,859 and 60,731 respectively. This represents a major problem for achievement of the FISP's objectives yet it has so far not received the attention it deserves. Levels of redemption of all coupons (including seeds) are reported in one study to be around 60% in 2011/12 increasing to 80% by 2012/13, though while this is taken to be encouraging and evidence that beneficiaries are 'using coupons as intended', in practice the 20% non-redemption by 2012/13 should be viewed with concern (CISANET, 2014).

In terms of subsidised fertiliser use, CIs show that in 2008/09 poorer households were more likely to report some 'other use' of subsidised inputs, though the finding only holds when households are ranked by wealth and there was statistically no difference based on wealth in the other years. The main reported other uses in that year were 'shared with others' or 'kept for next crop'. However, it is not clear how reliable and informative these responses are. Other evidence, including that from chapter 5, points to some households being prone to selling a portion of inputs (Dorward and Chirwa, 2011b, Holden and Lunduka, 2013). Given that input use is ultimately what determines the production-related impacts arising from the FISP, the issue clearly warrants further investigation in order to maximise returns to input use.

4.6.2 Some reflections on concentration curves and concentration indices

The results highlight a number of methodological lessons. Firstly, the study demonstrates the advantages of using CCs and CIs to measure targeting outcomes. CCs offer a comprehensive and intuitive visual insight into how targeting outcomes are distributed across a full sample or population ranked against a particular targeting criterion such as wealth status. This represents an advantage over single coefficients on variables estimated using regression analysis or a group of coefficients (e.g. representing wealth quintiles). An advantage of CIs compared to coefficients on grouped independent variables in regression is that the latter can tend to encourage a focus on comparing the two extreme categories (e.g. poorest and wealthiest), whereas CIs incorporate information right across the full sample of households. As such, CCs and CIs together facilitate rich quantifiable comparisons over time. Finally, it should be noted that CIs can be extended in various ways, such as including factors which may be considered a source of legitimate inequality (standardisation) and, with enough data, decomposing the importance of underlying determinants of SES-related inequalities (O'Donnell et al., 2008).

Some weaknesses of these methods should also be recognised, however. One is that where dichotomous outcomes are used and normalisation is required, one must be cautious of comparing the resulting corrected CIs with the standard CIs derived from continuous outcome indicators. More broadly, one must be careful of comparing CIs across different outcome variables in general given that they depend on the mean of the outcome. Even when comparing inequalities in the *same* outcome over time, one should be aware that large changes in the prevalence (mean) of that outcome would affect the CI. Nevertheless, comparisons in relative inequality over time can still be made in combination with CCs.

Another limitation is that CCs and CIs appear to be most appropriate in cases, like the FISP, where it is reasonable to assess targeting outcomes against one key indicator, against which households can be ranked (e.g. wealth or productivity). For policies where a large number of distinct criteria are involved or if households cannot be ranked against them, it would make sense to use other methods.

A more general reflection is that, as results for receipt of any fertiliser coupon and the number of fertiliser coupons received demonstrate, the choice of indicator clearly matters when it comes to measuring targeting outcomes. This suggests that future studies on targeting outcomes need to consider carefully the choice of outcome indicators used and what they are really showing and what they may be hiding. In the case of voucher subsidy programs, a dichotomous variable representing receipt of any coupon is likely to be a

poor outcome indicator as it lacks information and can underestimate the full extent of errors of inclusion (non-eligible households receiving subsidies) and errors of exclusion (eligible households not getting subsidies). It will also ignore the outcomes of possible sharing, which can obscure the fact that it may often be poorer households that share coupons with each other (Dorward et al., 2013).

4.6.3 Study limitations

Some limitations of the study should be highlighted. Firstly, as with all household surveys one must acknowledge the potential presence of reporting bias. There is reason to believe this may have arisen for questions such as non-redemption of coupons and the use of inputs given that coupon re-sale is illegal and sale of subsidised inputs a highly sensitive topic.

Secondly, the CC and CI approach used has been a bivariate one that does not directly account for other factors that may be considered sources of potential ‘fair inequalities’, e.g. if households were not chosen because they did not own land or if vulnerable households were targeted in spite of being wealthier than non-vulnerable households. However, as noted earlier, removing households with no land makes little difference to the results and it is unlikely that accounting for vulnerable households would make a difference, as the data suggest they also tend to be among those ranking lowest on indicators of SES. Nevertheless, future research could be carried out to decompose the factors driving (or at least associated with) the observed inequalities.

Thirdly, while it was not within the scope of the study, it should be recognised that the receipt of inputs represents only the direct benefits arising from the subsidy programme. Future research should look into the distributional aspects of wider benefits arising from indirect and general equilibrium effects and, for example, the impacts of differential displacement rates, of differential marginal productivity of incremental fertiliser, and of differential income multipliers.

4.6.4 Policy implications

The results provide clear evidence that the shift towards community-based targeting and open community meetings has not fully achieved the pro-poor targeting outcomes intended by the FISP. This puts into serious question the wisdom of the continued financial and opportunity costs of the FISP’s targeting procedures.

Before considering how best to address this problem, one must ask whether in fact the current targeting outcomes are indeed undesirable. It could be argued, for example, that by targeting those in the middle of the wealth distribution, the FISP may be reaching those who are still poor enough to not be able to afford unsubsidised fertiliser (one 50kg bag of Nitrogen fertiliser cost US\$ 45 in April 2014),²⁴ but wealthy enough to be able to effectively use the inputs. However, even if some poorer and more vulnerable households do struggle to use inputs as effectively as wealthier households, if the objectives of the programme continue to include achieving household food security, then the current targeting outcomes are indeed a problem. While there is still a case for less poor households getting subsidised fertiliser if they cannot afford the extremely high costs of fertiliser in Malawi, particularly given the challenges of reducing the market price, one must still address the failure to reach poorer households with sufficient inputs.

Based on findings from chapter 5 there appears to be a strong rationale in the context of Malawi for removing authority of beneficiary selection from village leaders, though there are practical and cost challenges in the implementation of targeting based on proxy means tests (PMT) of observable wealth indicators. For example, in order to minimise scope for interference by local leaders, it may require external enumerators to carry out data collection. However, this does not overcome the challenge that households have been known to give misleading information if they believe it will improve their chances of receiving transfers (Abdoulayi et al., 2013). Indicators would therefore need to be selected carefully to minimise the scope for misreporting. Furthermore, while involving considerably greater costs, according to estimates by Houssou and Zeller (2011) it may still fail to reach just under a third of households living under the poverty line even under the assumption of flawless implementation, due to limitations in the predictive power of PMT models used to identify cut-off points for the wealth indicators. However, it has been noted that combining a PMT approach for targeting in both the FISP and Malawi's Social Cash Transfer Programme could result in significant cost savings (Matita and Chirwa, 2014).

Given the exclusion errors and challenges that exist with the PMT approach, there is a case to be made for taking a look at a smaller rationed universal subsidy (i.e. a limited package available per beneficiary) open to land-owning smallholder farmers. There are many advantages to such an approach, including but not limited to: eliminating current errors of exclusion (the poorest not benefitting) without needing to increase the total

²⁴ Monthly national price for NPK 23 21 0 + 4S in April 2014 (AMITSA, 2014).

quantity of fertiliser going to less poor households, removing costs and difficulties of targeting, and increasing transparency and accountability (providing there are adequate communication campaigns) (Dorward and Chirwa, 2013b). Concerns over increased displacement of unsubsidised sales may well be misplaced as, while there would be some increase in less-poor households getting inputs, calculations suggest that if fertiliser coupons from 2012/13 were distributed evenly among wealth groups, the total quantity of fertiliser going to such households would actually remain at a similar level or decline.²⁵

One of the crucial challenges with a rationed universal subsidy would be getting the trade-off right between making sure that each household has sufficient inputs to be able to ‘step up’ and ‘step out’ of poverty rather than simply ‘hanging in’, while at the same time remaining fiscally manageable.²⁶ Ideally, the returns to input use would also be maximised through greater investments in extension services promoting more efficient input use.

As with any effective targeting approach, it would also require a much-needed national identification scheme to address the problems with using voting cards and existing farm family registers, including inflation of farming household figures. A further challenge would be securing the political will and leadership given possible fears among political parties of adopting a policy that appeared similar to the earlier ‘Starter Pack’ implemented by a previous government in 1999/2000 and 2000/01 (Dorward and Chirwa, 2013b: 12).

4.7 Conclusion

This paper has adopted an alternative approach to measuring beneficiary targeting outcomes in Malawi’s FISP, applying CCs and CIs to three rounds of household survey data from 2006/07 to 2012/13. The results bring our understanding of the FISP targeting outcomes more up to date and, by looking at various stages in the targeting process, offer new and richer insights into the complexities of the FISP’s targeting processes. Moreover, the study shows how the use of CCs and CIs, increasingly used in the health economics literature, can provide policy makers with a useful set of tools for understanding socioeconomic inequality associated with targeting outcomes. As well as CCs providing a rich and intuitive visual insight into targeting outcomes that cover the full distribution

²⁵Calculations available upon request.

²⁶ The notions of ‘hanging in’, ‘stepping up’ and ‘stepping out’ are discussed by Dorward et al. (2009).

of households, when combined with CIs they allow for quantitative comparisons over time.

Overall, results show that, despite some improvements since 2006/07, less poor rural households in Malawi continued to disproportionately benefit from the FISP by 2012/13, in particular those in the middle to upper-middle of the wealth distribution. This is despite the fact that the programme aims to realise specifically pro-poor targeting outcomes and despite the shift towards more localised community-based targeting and the advocacy of open community meetings for beneficiary selection. The inequalities arise partly through unequal access to fertiliser coupons, with wealthier households better able to acquire a larger number of coupons and, in turn, a disproportionate amount of subsidised fertiliser. Results also indicate that a higher number of poorer households may have had particular trouble in redeeming all fertiliser coupons in the early years of the programme and in using all of their subsidised fertiliser. However, further research is required to investigate this, ideally through a more qualitative approach.

The results ultimately raise serious questions over the ability of the community-based targeting approach used in the FISP to deliver pro-poor outcomes. The paper has also highlighted major weaknesses in the ability of households to redeem all of their fertiliser coupons at local depots. Urgent attention is required to address these problems in order to ensure that the programme achieves its intended aims and maintains credibility.

Preamble to research paper two

The previous chapter investigated the socioeconomic-related inequality in the transmission of fertiliser subsidies to beneficiaries in Malawi's FISP. It demonstrated how, despite attempts to improve targeting outcomes, for example, by introducing open meetings for sensitisation and beneficiary selection, as of the 2012/13 season it was those households nearer the middle of the wealth distribution that continued to benefit disproportionately.

The following chapter goes beyond measurement of targeting-related outcomes to try and understand the reasons *why* the FISP has struggled to achieve greater improvements in such outcomes. It is adapted from an article written by the author (currently under submission to Forum for Development Studies) and based on a qualitative research study that set out to investigate research objective two of the thesis, *to identify and assess the importance of different factors that determined the allocation and redemption of subsidy coupons in the FISP and use of subsidised inputs among smallholder households*. The study is based around primary research carried out by the author in Malawi in July and August 2013, involving 31 semi-structured interviews in villages and with Ministry of Agriculture staff at a number of different levels.

Luke Harman designed the study, analysed the data and drafted the paper. Professor Andrew Dorward and Dr Catherine Goodman provided advice and support throughout the research process, including comments at the drafting stage.

5 ‘No room for talking’: Explaining Beneficiary Level Targeting Outcomes in Malawi’s Farm Input Subsidy Programme

Abstract

Contrary to policy objectives, evidence suggests that less-poor households are more likely to directly benefit, and to benefit more than poorer households do from Malawi’s Farm Input Subsidy Programme. Understanding why is essential for guiding appropriate policy improvements. To investigate, in-depth interviews were carried out in four villages from two districts within the central and southern regions. Beneficiary and non-beneficiary farmers and village heads were interviewed, along with Ministry of Agriculture staff from village, sub-district, district and national levels. Coding and analysis of the interview transcripts reveal the crucial importance of power and informational asymmetries in determining the allocation of subsidy coupons, access to and use of subsidised fertiliser. In particular, village leaders and fertiliser depot staff hold privileged positions in which, under certain circumstances, they are able capture benefits for themselves and/or distribute benefits on the basis of favouritism, patronage or rent seeking. Village heads also enforce sharing, in some cases potentially as a means of covering up malpractices. Poverty was also found to be an important determining factor in how households used coupons and any subsidised fertiliser received, given the pressing cash constraints and pressing needs poor households face, raising questions over whether greater integration with other social protection measures is required.

5.1 Introduction

Since the turn of the millennium there has been a renewed political and policy drive to tackle the persistence of extreme poverty and food insecurity. In addressing these issues, agriculture has been singled out as a sector deserving special attention. There has been a particular renewal of interest in the use of agricultural input subsidies (AISs), with a recent review documenting nine AIS programmes (AISPs) that started within sub-Saharan Africa since the early 2000s (Jayne and Rashid, 2013).

Universal input subsidies were a pervasive element in policies underpinning ‘Green Revolution’ transformations in the 1960s and 1970s, though some argue they ended up becoming expensive, inefficient and disproportionately captured by better-off farmers and / or input industries (Gulati and Narayanan, 2003). In response to the rising number of AISPs introduced in recent years, there have been calls to learn from this experience and develop AISPs that are ‘Market Smart’ (Morris et al., 2007). The key elements of such an approach are that subsidies are temporary, do not distort the relative price of inputs in a way that would encourage excessive use, and that they support rather than undermine the development of private sector input markets.

One implication of the market smart approach is that subsidies should generally be targeted to farmers who would not otherwise purchase commercial inputs, as a means of both limiting fiscal costs and improving efficiency while stimulating demand and use. Subsidies reaching wealthier households are more likely to displace unsubsidised commercial sales, lowering incremental input use and potentially undermining private sector input suppliers (Ricker-Gilbert et al., 2011, Xu et al., 2009). Among recent AISPs, such targeting is often done through decentralised targeting processes and the use of vouchers (coupons) (Chirwa and Dorward, 2013a, Dorward, 2009).²⁷

Malawi’s Farm Input Subsidy Programme (FISP) is the most researched and well-known example of recent AISPs, with a growing evidence base relating to targeting outcomes, much of this based on large quantitative surveys. However, while such surveys help measure targeting outcomes, aside from a few multiple choice questions on processes, they say fairly little about the underlying determinants of the allocation and use of subsidised inputs, which is essential knowledge for policy-makers wishing to make improvements to the programme.

²⁷ The terms voucher and coupon are used interchangeably in the paper.

A more qualitative approach can be an important complement to quantitative research. As Prowse and Camfield (2013: 55) note, qualitative methods are able to shed light on the questions of ‘how’ and ‘why’ and, as such, ‘are good at capturing processes and pay greater attention to why certain individuals benefit from an intervention and others do not’. While some limited qualitative evidence on targeting processes in the FISP does exist, e.g. (Dorward et al., 2013, Holden and Lunduka, 2012b, Mvula et al., 2011), these studies have not directly focused on explaining the key determinants of outcomes at each of the three stages of beneficiary identification, coupon use / access to inputs, and subsidised input use (see Figure 14). The qualitative work to date has also not been widely circulated, leaving an important gap in wider awareness about how subsidies are being distributed and used in Malawi’s FISP.

This paper therefore seeks to build upon the limited qualitative research on the FISP by identifying and assessing the importance of different factors that determined the allocation and redemption of subsidy coupons and use of subsidised inputs during the 2012/13 season.²⁸ In doing so, it also contributes to the wider literatures on decentralised targeting and elite capture, providing a specific case study through which to investigate a number of theoretical assumptions around the advantages of community-based targeting (CBT).

The paper draws on new primary data gathered by the author from 31 in-depth semi-structured interviews with a wide range of actors covering four separate villages across two districts. Interviews were coded and then analysed using Framework Analysis to identify key themes explaining outcomes at three levels: beneficiary selection, use of subsidy coupons and use of subsidised inputs. While the study does not allow us to generalise findings to a national level and caution should be taken in interpreting responses from interviews, the study does make an important contribution to the literature on explaining targeting outcomes in the FISP including why the objective of pro-poor targeting is not being effectively met, and to the broader literature on the use of CBT in development programmes.

The next section provides a conceptual background to the use of CBT and voucher subsidies, including theoretical advantages and trade-offs. Section 5.3 gives a background to Malawi, the FISP and related evidence on targeting outcomes. Section 5.4 then describes the methods used in this study before section 5.5 sets out the main findings.

²⁸ 2012/13 describes an agricultural season as the main agricultural season in Malawi covers two calendar years, from around November to May.

Section 5.6 draws together the main contributions of the study and considers implications for policy.

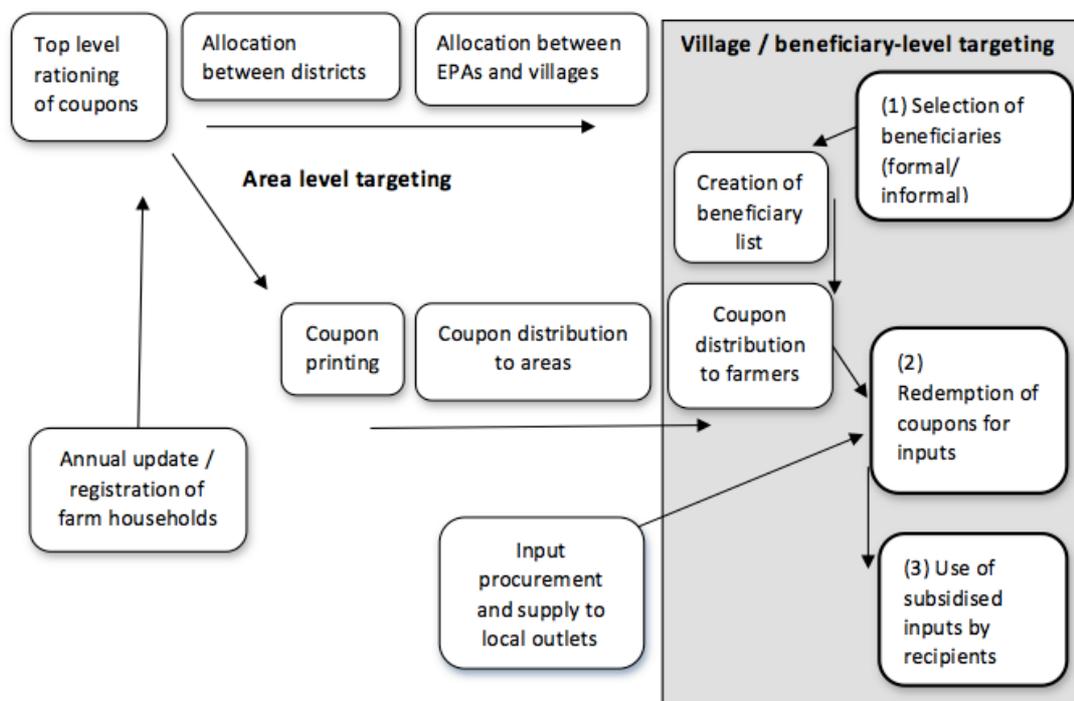


Figure 14: Overview of main stages in the subsidy allocation and use process
Source: Author.

5.2 The use of CBT and vouchers in AISPs

The targeting process in AISPs involves the following main stages:

- (1) Agreement on who should be targeted;
- (2) Establishment of criteria / indicators for beneficiary identification;
- (3) Beneficiary identification and selection; and
- (4) Transmission of subsidised inputs to identified beneficiaries.

Stages 2 to 4 form the main focus of this paper, though the findings suggest implications for stage 1. While the establishment of targeting criteria depends on programme objectives, a range of alternative targeting mechanisms can be used to identify and select beneficiaries. These range from means tests (based on information about income), to proxy-means tests (PMTs) (based on observable proxy characteristics of wealth such as quality of housing), categorical targeting (all those in a particular group or area), CBT

(beneficiaries being chosen at a local level) or self-selection (Coady et al., 2004). A useful conceptualisation by Houssou and Zeller (2011) considers the choice of mechanism as representing a trade-off between accuracy and practicality, with a means test theoretically allowing for the most accurate targeting but being least practical, especially in most low-income country (LIC) settings given the absence of, and high costs of obtaining and maintaining, up-to-date information (Besley and Kanbur, 1990). Partly for this reason, as well as an alignment with the narrative on decentralisation and democratisation, as well as for political reasons, CBT has become a particularly popular choice in AISPs.

Theoretical advantages of CBT include it being able to draw on local knowledge and preferences (Mansuri and Rao, 2012), local decision makers being more accountable than centralised decision makers (Bardhan, 2002), and benefits from strengthening of social capital, community organisation and beneficiary empowerment (Fox, 1996). One large cross-country review of targeting approaches in development programmes found 14 cases of CBT, associated with ‘good results on average’, though there was considerable variation and it was believed the examples found may have performed unusually well, in part due to other forms of targeting often being used alongside CBT (Coady et al., 2004). However, while cross-country evidence can provide useful insights, one must be careful of drawing general conclusions about broad targeting approaches.

Indeed, on the other side, CBT holds a strong political appeal in systems based on patronage as it can present an opportunity for local decision makers to divert and use transfers to their benefit, leading Mansuri and Rao (2012) to suggest CBT involves a trade-off between benefitting from local information and the hazard of ‘local capture’. One of the problems with CBT is if those in positions of power (e.g. local leaders and those involved in decision-making) are able to extract rents through their privileged positions. Bardhan and Mookherjee describe the phenomenon of ‘elite capture’ as when inequalities between different socio-economic classes (e.g. in terms of political rights, awareness and political participation) translate into ‘higher implicit welfare weights assigned to wealthier and more powerful classes in policy-making and implementation’ (Bardhan and Mookherjee, 2012: p. 2). In contrast to the findings by Coady et al. (2004), Platteau et al. (2014) note that a major result emerging from the economics literature on intra-community preferences is that ‘the resource allocation process typically reflects the preferences of elite groups’. They note that more unequal communities tend to fare worse ‘especially when there is a concentration of political, economic and social power in the hands of a few’. Pan and Christiaensen (2012) also cite a number of studies which suggest

that political, economic, sociological and programme design features can all influence the likelihood of elite capture in different contexts, including the programme's size, eligibility criteria and whether it involves the distribution of public or private goods, local power structures, levels of awareness, income levels and poverty and community homogeneity.

In Malawi, there is reason to believe that elite capture and patronage may play a key role in FISP's CBT. For example, previous research finds neo-patrimonialism and social relationships based on inequality and a large 'power distance' to be characteristic features of the country's political economy (Booth et al., 2006). In addition, in a study of the FISP, Kilic et al. (2013) found evidence that those in positions of local authority have indeed benefitted disproportionately from CBT mechanisms.

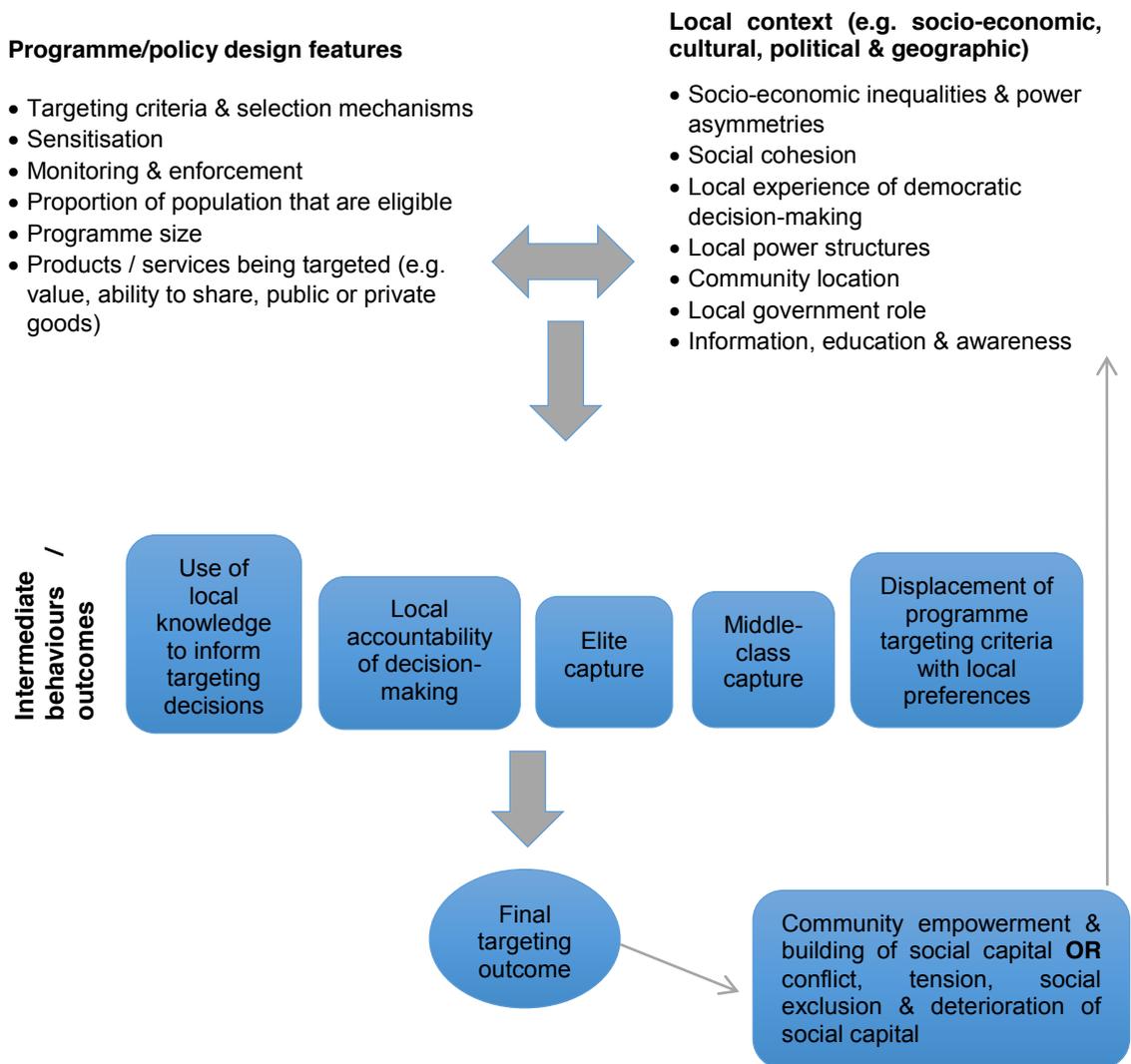
Drawing on the literature around decentralised targeting and elite capture, Figure 15 sets out a framework to help conceptualise the various factors that may influence targeting outcomes, and specifically beneficiary selection, under CBT. Central to eventual targeting outcomes are the programme or policy design features and the local context, and how these both interact. These underlying conditions can be seen to then determine which of the theoretical advantages or disadvantages of CBT emerge (see 'intermediate behaviours/outcomes'), which in turn influence overall targeting outcomes. Finally, depending on these outcomes, this may lead to a strengthening or deterioration in community cohesion and levels of conflict, feeding back into the community-level context.

In terms of programme design and implementation, a number of features have been suggested to influence CBT outcomes, including those mentioned above. For example, Coady et al. (2004) have argued that CBT may work best 'when the community is asked to choose only a few members for program receipt, say five or ten per cent, rather than when closer to half the community might benefit' (Coady et al., 2004: 62).

In terms of local context, Pan and Christiaensen (2012) found evidence of elite capture in an AISP in Tanzania, and for it to be more pronounced in communities with more unequal land distributions and that were further from rural towns. In their study of Sierra Leone, Acemoglu et al. (2014) found that, in areas with fewer ruling families, a number of socio-economic outcomes were significantly worse. They argue that this is due to chiefs being less constrained and better able to 'engage in economically undesirable activities through their control of land, taxation, regulation and the judicial system' (Acemoglu et al., 2014:

31). By contrast, Turley et al. (n.d.) found little evidence that more powerful chiefs diverted more than less powerful ones in Sierra Leone, though this evidence emerged from a controlled field experiment, which may have been more likely to suffer from the Hawthorne (observer) effect. It is also possible that those who are better educated and connected may benefit from greater information and be better able to ‘work the system’ to capture benefits. This is similar to the notion of ‘middle-class’ capture, as discussed by Bertram (1988).

Figure 15: A framework for understanding beneficiary selection using community-based targeting



Source: Own conception.

Regarding transmission of subsidies (stage 4), vouchers have become a particularly popular means of providing indirect subsidies. These have typically been paper-based vouchers though there has been increasing use of e-vouchers using mobile phones in recent years. After issuing selected beneficiaries with vouchers, they must then redeem them at designated outlets, sometimes with a co-payment or ‘top-up’.

A range of theoretical advantages of this approach have been put forward such as helping to target specific groups of individuals, facilitating demand-led growth of private sector input markets where vouchers can be redeemed among private sector retailers (Roll Back Malaria, 2005), and assisting in graduation away from subsidies over time by reducing voucher values (Morris et al., 2007: 107-108).

However, there are also potential major weaknesses, with vouchers being prone to capture and misuse, creating secondary markets for both the coupons themselves and the products for which they are redeemed (Holden and Lunduka, 2012b). Controlling such corruption also represents a considerable financial cost (Morris et al., 2007: 107-108). Evidence from voucher-based PHPSs highlights that various obstacles may prevent voucher redemption, especially among the poorest, including vouchers being lost, lack of perceived need for the subsidised products and lack of knowledge over where to redeem the vouchers and lack of stock in retail outlets (Jones and Mponda, 2006, Kanya et al., 2014). The framework developed in Figure 15 above is also likely to apply in general terms to the use and redemption of vouchers, for example, in terms of the role of inequalities and power asymmetries in influencing outcomes.

5.3 Malawi’s FISP and evidence on targeting outcomes

5.3.1 A background to Malawi and the FISP

The Malawian economy relies heavily upon agriculture, with around 85% of households engaged in the sector (NSO, 2012). Maize is the predominant staple crop, grown by nearly all agricultural households in 2005 (NSO, 2005) and the average cultivated area was 1.4 hectares in 2009/10 (NSO, 2012).

For a range of reasons including high dependence on rain-fed agriculture and vulnerability to weather shocks, poor soil fertility, high input and transport costs and a rapidly growing population, up until the start of the FISP Malawi had faced declining per capita maize availability (Harrigan, 2008), plus a number of devastating food crises (Figure 16).

AISs have played a major part in post-independence Malawian agricultural policy and have been implemented against a background of fluctuating donor support (Figure 16). While AISs had fallen out of favour in mainstream international policy circles during the 1980s and 1990s, due to problems of chronic food insecurity a rationed universal subsidy (the Starter Pack) was introduced in 1998, which evolved into more targeted scaled-down programmes in subsequent years (Levy, 2005). Most recently, after a particularly bad episode of food insecurity hit the country in 2002 and again in 2005-06, President Bingu Wa Mutharika went against considerable opposition from some donors to implement a larger scale targeted input subsidy programme - The Agricultural Input Subsidy Programme - later renamed the FISP.

5.3.2 FISP objectives and key features

By 2012/13 the FISP had been running for seven years and had undergone a number of changes (Chirwa and Dorward, 2013a). Given the focus of this study on 2012/13, this section focuses on modalities and guidelines for that season.²⁹

As of 2012/13, the purpose of the FISP was 'To increase resource poor smallholder farmers' access to improved agricultural farm inputs' and its objective was 'To achieve food self-sufficiency and increased income of resource poor households through increased maize and legume production.' (MoAFS, 2012). The programme involved the distribution of subsidy coupons, which could be redeemed at designated outlets across the country for specific agricultural inputs. Each beneficiary was supposed to receive four coupons: one each for a 50kg bag of Nitrogen-Phosphorus-Potassium (NPK) and urea, one for a 5kg (hybrid) or 8kg (Open Pollenated Variety) bag of maize seed and one for either a 2kg pack of groundnuts, beans, cowpeas or pigeon peas or 3kg of soya beans. Beneficiaries were also entitled to a 200g bottle of maize storage pesticide, though there were no coupons for these and they are not discussed further.

The total amount of subsidised fertiliser allocated consisted of 75,000 metric tonnes (mt) of NPK and 75,000mt of urea, to cover a total of 1.5 million beneficiary households. Fertiliser was to be made available through outlets of two parastatals: the Agricultural Development and Marketing Corporation (ADMARC) and the Smallholder Farmers Fertiliser Revolving Fund of Malawi. Each bag was to be sold to beneficiaries for 500 Malawian Kwacha (MWK) (approximately US\$ 1.60) upon presentation of a valid

²⁹ Further contextual and other details on 2012/13 can be found in (Dorward et al., 2013).

coupon.³⁰ While there is geographical variation in market prices, this represented an average subsidy per 50kg bag of around 96%.³¹ 1.5 million coupons for maize seeds and the same for legume seeds were also allocated, redeemable at licensed agro-dealers, with a ‘top-up’ charge of up to 150MWK (US\$ 0.47) permitted for hybrid seed but none for composite seed or legumes.

5.3.3 Official targeting guidelines and processes

According to the 2012/13 guidelines, within each district the District Agricultural Development Officer (DADO) had overall responsibility for ‘constituting teams ... [facilitating] farmer sensitization, beneficiary identification and coupon distribution exercises in an open forum on given and well publicized dates’ (MoAFS, 2012). Key members of these teams were Agricultural Extension Development Coordinators (AEDCs) who were overall responsible at the Extension Planning Area (EPA) level and in turn supervised a team of Agricultural Extension Development Officers (AEDOs), responsible for a number of villages within an EPA. It is the AEDOs who were expected to ‘facilitate community mobilization for beneficiary identification and coupon distribution exercises’, ‘facilitate the identification of beneficiaries and coupon distribution at an open forum’ and distribute coupons to registered beneficiaries. The open forum was intended to ‘ensure transparency and accountability’. Dates and locations for registration were supposed to be announced in advance through ‘media’ and local leaders. Communities were also supposed to be sensitised by Ministry of Agriculture and Food Security (MoAFS) staff on the programme details at the open forum, such as those relating to overall processes, targeting criteria, the subsidy package and the number of beneficiaries that year.

Other actors supposed to be involved in identifying beneficiaries were the District Commissioner or their representative, Village Development Committees (VDCs), Area Stakeholder Panels and community policing members and police officers. Village heads and Traditional Authorities, both of whom form part of the traditional chieftaincy hierarchy in Malawi, were only supposed to be ‘providing *support* during [the] farmer

³⁰ Based on an exchange rate of US\$1 =320 MWK covering December 2012 and January 2013 (months when inputs are typically purchased). This rate is used for all reference to prices from the 2012/13 season.

³¹ Based on the combined average market price for NPK and urea of 14,185 MWK for 2012/13. Figures from the Fertiliser Association of Malawi.

sensitization and beneficiary identification exercise’ and faith group leaders and political leaders were also allowed a role in providing support during these stages.³²

In 2012/13, the FISP aimed to target ‘resource poor Malawian[s]’, ‘resident in a village’ and ‘own[ing] a piece of land’ to be cultivated in the 2012/13 season. Beneficiaries were supposed to hold a valid voter registration card. The definition of resource poor was not defined further, though the guidelines stressed that the following vulnerable groups ‘should also be considered’:

- elderly resource poor household heads;
- HIV-positive resource poor household heads;
- resource poor female-headed household heads;
- resource poor child-headed and orphan-headed households;
- resource poor physically challenged headed household heads; and
- resource poor household heads looking after the elderly and physically challenged.

Only one beneficiary per household was supposed to be registered and the MoAFS was clear that any sale of coupons was illegal. In addition, coupon sharing (and therefore input sharing) was ‘absolutely discouraged’ as it was believed to jeopardise the objectives of the programme. Once beneficiaries had redeemed their coupons they were supposed to use all of the subsidised inputs they acquired on their own land.

³² Emphasis added.

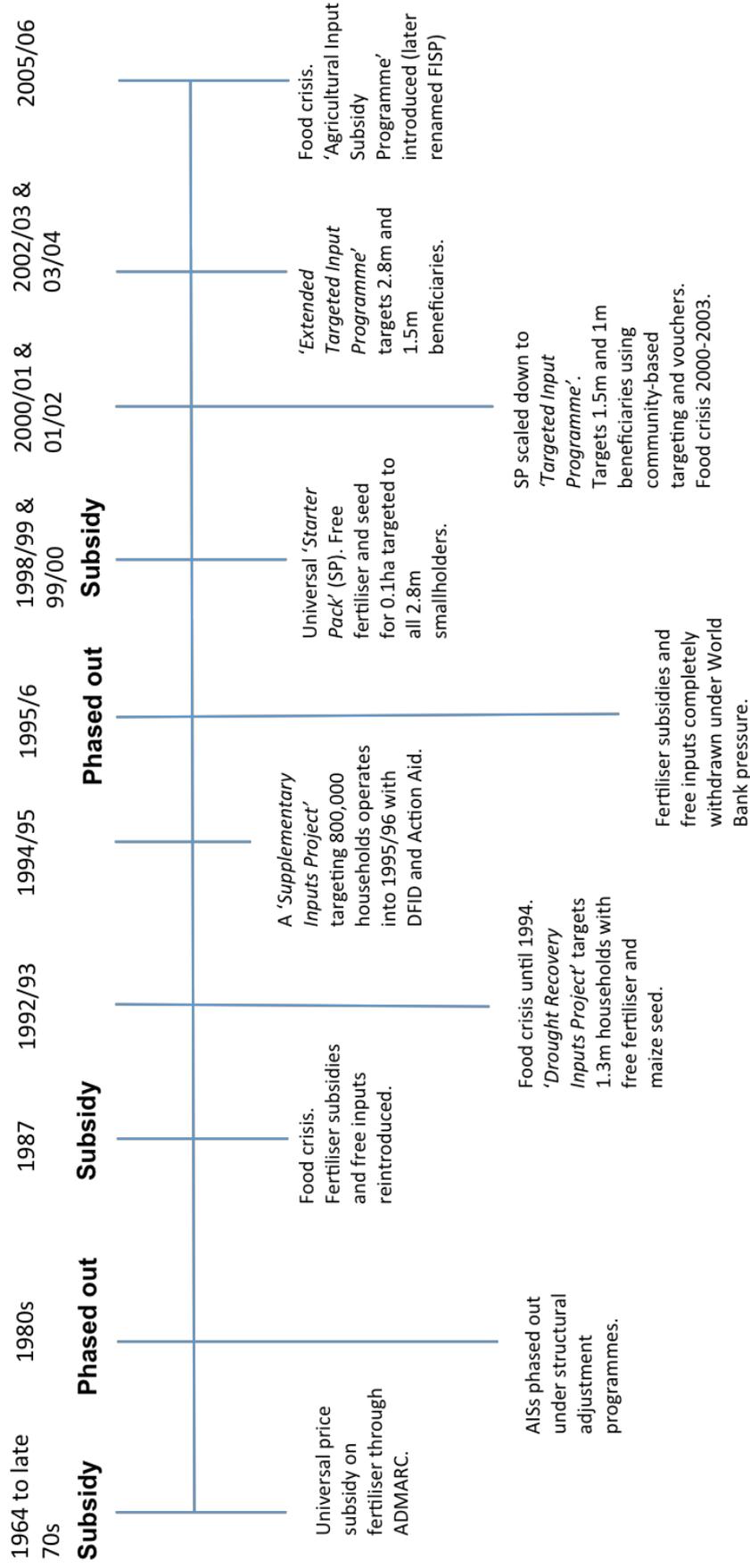


Figure 16: History of agricultural input subsidies in Malawi

Source: Own conception based on (Harrigan, 2003, Harrigan, 2008, Øygard et al., 2003)

5.3.4 Evidence on beneficiary level targeting outcomes in Malawi's FISP

A number of studies have measured beneficiary level targeting outcomes in the FISP with results indicating that the FISP's CBT approach has been failing to effectively target resource poor and vulnerable households, with land size, livestock and asset ownership generally positively and statistically associated with receipt of coupons or the amount of subsidised fertiliser received (Chibwana et al., 2012, Chirwa et al., 2011b, Holden and Lunduka, 2010a, Kilic et al., 2013, Ricker-Gilbert and Jayne, 2011, Ricker-Gilbert et al., 2011). The disproportionate benefit identified in these studies might suggest elite capture or rent seeking but they do not tell us what is actually happening.

Some questions from household surveys do provide further insights though still leave many questions unanswered. Table 15 below presents data from the 2012/13 FISS, which lead to the following observations and questions:

- **Allocation of coupons.** Most but not all of those surveyed appear to have received some coupon but less than the full package, indicating sharing, and there was quite a range of different combinations received. What explains this?
- **Redistribution of coupons.** Many respondents suggest redistribution took place, but what does it mean and how is it done?
- **Open meetings and importance of people involved.** Open meetings were often reportedly used for allocation of fertiliser coupons and even more so for distribution of fertiliser coupons. However, when asked who decided on who got vouchers, village heads were those most commonly reported to have decided despite the guidelines that they should merely provide 'support'. What explains this?
- **Use of coupons.** Most coupons were reportedly redeemed for intended inputs, though there were some cases of coupons not being used. The main reported reason for non-redemption was lack of stock. What causes this and what else might explain non-redemption? Are some coupons sold and under-reported?

Some qualitative evidence does exist on targeting processes and challenges facing access to subsidy coupons and access to subsidised inputs. This comes from FGDs, life stories and key informant interviews as part of the independent monitoring and evaluation of the FISP (Dorward et al., 2013, Mvula et al., 2011) with some further insights from separate surveys (Holden and Lunduka, 2012b). These studies raise a number of important additional findings, such as village heads adding their own criteria, there being fewer

coupons arriving than registered beneficiaries, malpractice by officials and leaders, secondary markets for coupons and inputs and a range of challenges in accessing subsidised fertiliser. However, the studies do not provide an overall picture of the main factors that are driving targeting outcomes in the FISP and the heavy reliance on FGDs runs the danger of people holding back in what they say, marginalised voices being missed, and distortion of actual events.

Table 15: Selected data from 2012/13 Farm Input Subsidy Survey

	N=	Percentage [95% confidence intervals]
Number of households sampled	2001	
Households getting any share of a fertiliser coupon		60.1 [56.7, 64.3]
Range of fertiliser coupons received		
Under one		11.2 [8.2, 15.1]
One		31.9 [28.2, 35.8]
Over one to two		16.9 [14.2, 20.0]
More than two		0.6 [0.3, 1.2]
How fertiliser coupons were used	2044	
Used to buy inputs		95.0
Did not use		4.3
Other		0.7
Reason for not buying fertiliser with coupon (Two most common answers)	101	
No stock in selling point		67.3
No money to buy inputs		6.9
Main use of fertiliser acquired with coupon	1942	
Used in own garden		96.1
Shared with others		2.7
Sold		0.4
Other		0.8
Who decided which households in your village would receive fertiliser vouchers? (Two most common answers)	1964	
Village head		73.2 [70.1, 76.1]
Village Development Committee		9.7 [7.8, 11.9]
Use of open meetings in allocation of fertiliser vouchers	1964	
Yes		71.1 [67.8, 74.2]
No		27.6 [24.4, 31.1]
Don't know		1.3 [0.7, 2.2]
Use of open meetings in distribution of fertiliser vouchers	1964	
Yes		80.1 [77.7, 82.3]
No		18.7 [16.4, 21.1]
Don't know		1.2 [0.7, 2.2]
Redistribution of fertiliser coupons in the village	1964	
Yes		60.9 [55.8, 65.7]
No		35.3 [30.6, 40.3]
Don't know		3.8 [2.7, 5.3]

Source: Farm Input Subsidy Survey 4 (FISS4). Note: All questions apart from how fertiliser coupons and subsidised fertiliser were used and reasons for non-redemption of coupons use household weights.

5.4 Methodology

As noted above, the study adopts a qualitative approach in order to move beyond measurement of targeting outcomes towards an understanding of what *explains* beneficiary selection and the transmission of subsidies to final beneficiaries. Semi-structured interviews were chosen for data collection in order to elicit richer and more open responses than may have been possible with focus group discussions. They were also a practical option, offering the flexibility to consistently investigate the same key themes with a wide range of stakeholders, including staff from the MoAFS, through the same format.

Semi-structured interviews were carried out in July and August 2013 in the central and southern regions of Malawi, which contain around 87% of the Malawian population (NSO, 2008). These regions can be further decomposed into a number of different Livelihood Zones in which households show commonalities in the way they obtain food and income. Within each of the central and southern regions, one district was purposively selected to ensure that two of Malawi's most populated Livelihood Zones were included in the sample. In each of the two districts, two villages were then purposively selected from a list of those included in the FISP's 2010/11 household monitoring and evaluation survey. Given evidence cited above suggesting elite capture may be more pronounced in areas further from rural towns, one village was randomly selected out of a list of those very close to a trading centre and one from those that were further away. The four villages are referred to as village A, B, C and D. Summary data are provided in Table 16.

In each village, four farmers were selected, including two recipient households from the 2012/13 programme and two non-recipients. Beneficiaries were randomly selected from the beneficiary register, which is the official list of all those formally selected as coupon beneficiaries within the village.³³ Non-beneficiaries were randomly selected from a list provided by the village head. Table 17 presents summary information of the farmers interviewed. In each village the village head (also a farmer) was interviewed. This position of traditional authority is generally passed on through an ancestral line. From the MoAFS, the AEDOs responsible for each of the four villages and the AEDCs responsible for each of the four EPAs in which the villages were located were interviewed. Along

³³ Completion of the beneficiary register is carried out before individuals actually receive coupons and, because of this and subsequent sharing arrangements, it cannot be taken as an accurate list of actual beneficiaries. For sampling purposes, however, it was the most reliable source available.

with two district-level MoAFS employees and one MoAFS officer from the ministry headquarters, this brought the total number of interviews to 31.

It is important to note that the sampling method is not intended to be statistically representative of any administrative areas but instead aims to gather a more in-depth understanding of targeting processes from the views of a wide range of different individuals from four separate areas across the country.

Interviews involved questions on processes for coupon allocation, access to inputs, and input use. A sample template from interviews with farmers is given in Appendix 13. Interview transcripts were imported into NVivo and analysed following the Framework Approach (Ritchie and Spencer, 1994). The initial coding framework was structured around determinants of coupon allocation, coupon use and input use, based on *a priori* themes from the input subsidy literature. Further themes were allowed to evolve from the data itself. After coding, the data were charted to build up a picture for each area and to identify differences between actors.

Interviews with villagers, village heads and AEDOs were carried out in Chichewa using consecutive interpreting with the assistance of a Malawian interpreter. Interviews with MoAFS employees from the EPA level upwards (AEDCs) were carried out in English where the interviewee was comfortable doing so. Informed verbal consent was given by each interviewee, with each individual interviewed separately and without use of audio recording so as to elicit free and open discussion and encourage trust, confidence and openness during interviews.

Table 16: Summary of villages visited

	District 1 (Central region)		District 2 (Southern region)	
	Village A	Village B	Village C	Village D
Number of farm households in village (2012/13) (Village head estimate) (AEDO estimate)	62 NA	51 48	362 NA	180 127
Average household size (From 2010/11 FISS)	4	5	4	5
Approximate village population based on: (Village head estimate) (AEDO estimate)	248 NA	255 240	1448 NA	900 635
Gender of village head	Female	Male	Male	Male
Number of years head has held position	13	19	10	6
Distance to nearest trading centre (Village head estimate) (AEDO estimate)	30 min walk 3km	1.5km 1km	0.5km 1.5km	* 5.5km
Distance to nearest ADMARC fertiliser depot (Village head estimate) (AEDO estimate)	2 hour walk 15km	2km 4km	1km 1.5km	* 5.5km
Number of coupons village received according to head 2012/13 2011/12 2010/11	21 8 NA	18 19 20	80 64 43	49 49 74
Number of villages in the EPA (from AEDC)	861	731	340	150
Number of smallholder families in EPA (from AEDC)	26,000	21,293	35,663	23,706
Mean number of families per village in the EPA	30	29	105	158
Mean village to AEDO ratio in the EPA	43	52	49	30
Villages sampled AEDOs were responsible for in 2012/13 +	79	69	25	16

Source: Interviews. Notes: Village heads gave higher household estimates than AEDOs, which could be due to more up-to-date information or incentives to inflate numbers to secure a higher number of coupons. It was noted by one district level MoAFS official how heads had learnt to cheat the system by inflating their farm family figures. * Estimate by village head not reported as it referred to distances to a new trading centre which had opened after the 2012/13 FISP coupon allocation. + AEDOs in village A and B both noted they would be responsible for considerably more villages in the 2013/14 season. The AEDO for village B indicated a 13 % increase (from 69 to 78).
NA = not available.

Table 17: Characteristics of coupon recipients and non-recipients interviewed (not including village heads)

Gender of household head	Household size	Fertiliser coupons	Other coupons	Cement floor, concrete walls or iron roof	Livestock	Total hectares	Highest education within household
Coupon recipients							
Female	4	NPK	Maize	No	No	0.2	Standard 5
Male	6	NPK, Urea	Maize	Yes	No	0.6	Standard 7
Male	3	NPK, Urea	Maize	Yes	No	1.8	Form 4
Male	8	NPK, Urea	Maize, Legume	Yes	No	2.9	Form 1
Male	2	NPK	Maize	No	Yes	1	Standard 8
Female	2	Unspecified (farmer got CAN)	Maize	No	No	0.3	None
Male	5	Urea	Maize	No	No	1	Standard 7
Female	3	NPK	Maize	No	No	0.7	Standard 4
Female	6	NPK, Urea, Unspecified	Maize	No	Yes	1.1	Standard 8
Male	4	Urea, Unspecified	Legume	No	Yes	0.5	Standard 8
Non-recipients							
Female	5			No	Yes	0.2	Standard 8
Male	3			No	Yes	0.9	Standard 8
Female	5			No	Yes	Unsure	Standard 5
Male	2			No	Yes	2.4	Standard 7
Female	4			No	No	0.6	Standard 2
Female	2			No	Yes	0.8	Standard 6

Source: Interviews. Notes: (i) interviews revealed that while certain farmers are not formal beneficiaries, they end up being coupon recipients through redistribution (sharing). However, the non-recipients interviewed in this study were those who had not received any share of a coupon. (ii) 20 out of the 27 coupons were shares of a single coupon. Land ownership is that which household owns or has cultivation rights over, excluding land rented in. Education levels increase in chronological order from Standard 1 to Form 4.

5.5 Key findings

The findings are structured around the three stages of beneficiary level targeting from Figure 14. Each section starts with a brief overview describing outcomes across the villages, leading into the common factors explaining the outcomes for that level.

5.5.1 Selection of beneficiaries and coupon allocation

Based on their housing, ownership of livestock, land and other assets, most recipients appeared to fit the criteria of being ‘resource poor’. However, two beneficiaries from village C were clearly among the wealthiest in the area, one owning a TV and satellite dish and another running a beer brewing enterprise and local bar. In addition, it was noticed when going through the beneficiary register for Village A that the head, who was far from resource poor, was registered as the first person on her village’s beneficiary list. It was widely recognised by AEDCs that heads consider themselves entitled as beneficiaries. One AEDC explained, *‘When it is time for registration, instead of writing names they start with themselves as one or they put their wife’s name down the list. Others have been very clever; you give them a figure of twenty, they just register fifteen and keep five.’* Although the interviews did not reveal clear evidence that elite capture was more pronounced in more remote locations, they did suggest that certain factors associated with distance may be important, such as whether the village head is strong, the extent to which the AEDO provides adequate oversight and whether there are business people nearby to whom the head may be tempted to give or sell coupons.

At the same time, a number of the non-beneficiary farmers interviewed appeared particularly resource poor and vulnerable, met the land-owning criterion, yet still received no share of any coupons in 2012/13 (Table 17). This included four female-headed households, one of which was headed by an elderly woman looking after two orphans (village C). These households reported either never having received the subsidy or not receiving it often.

No households reported receiving the full package of coupons. It was reported by farmers and heads in all villages that the head asked beneficiaries during coupon allocation to share the inputs associated with the coupons with other specific households. The highest share of coupons received was one respondent reporting a 50% share of all four coupons and one reporting a 50% share of all but the legume seed. These were the two wealthy individuals mentioned above. The remaining recipients got various combinations of

fertiliser and seed coupons, with some sharing inputs among three or four households. The main explanation for sharing was that there were too few coupons for the number of poor households in the village. It was noted by farmers in two villages that those with whom the inputs were to be shared were either ‘favoured’ (village A) or from the head’s own ‘clan’ (village D).³⁴ The head of village A explained that she asked beneficiaries to share among those involved in ‘development activities’ within the village (i.e. communal activities such as making roads, communal gardens or moulding bricks).

The interviews revealed the most important determinants of targeting outcomes to be the inclinations of village heads and village politics, discussed below in turn.

The inclinations of village heads

‘The biggest problem is involvement of the village leaders. If they start selling coupons this programme will never work. Also, ordinary villagers cannot go to the government without going through the village head, so they depend on him. If he is not doing things right then the whole programme is in a total mess.’ -Male beneficiary farmer

In terms of processes, in all four villages the heads were central to decision making and played a gatekeeper role to the outside world. Three heads suggested they were assisted in choosing beneficiaries by a VDC, one of them also involving the *nduna* (the head’s relative and next-in-line). The remaining head explained a VDC had not been functioning for a long time and reported choosing with a birth attendant and the *nduna*. However, farmer interviews could not always corroborate the involvement of a VDC and the large majority, along with MoAFS staff, agreed that heads often wield most influence while a smaller minority, including two heads, suggested that the VDCs can be as or more influential.

The central importance of the head was reinforced by findings of limited involvement of ordinary farmers. Across all four villages, farmers (and village heads) explained that farmers were not involved in actual decision making. In three villages, they were simply called once decisions had been made regarding who should get coupons and with whom they should share. In village D, villagers received more information as a meeting was

³⁴ The term clan refers to individuals coming from a particular ancestral line. The number of different clans in a village may be large or small depending on its history. Within the Chewa ethnic group, the term *mbumba mbumba* is also used to refer to children from the same mother who together comprise a particular family.

organized by the AEDO, though even there the village head simply read out who should receive coupons and with whom they should share. It was generally recognised by farmers, heads and certain MoAFS staff that farmers were then not able to question decisions made. As one AEDO remarked, *‘Even if there are open meetings, the village head is the owner of the village. People can be angry but at the end of the day his say goes’*. All AEDOs were clear that, even if villagers are present, the village head, sometimes with a VDC, ultimately makes the decisions. Two AEDOs encouraged this approach as being more streamlined in order *‘to avoid problems and quarrelling’*. One said it would be very hard to follow the procedure of an open forum, saying, *‘It will be chaos’*.

A lack of awareness among most farmers about the official criteria, entitlements and procedures for selection further underscored the degree of power held by village heads. In three villages nearly all farmers interviewed were unaware of the formal criteria. The two farmers that were aware of the formal criteria were the two wealthy individuals mentioned previously. Two other farmers interviewed believed that beneficiaries should be receiving just one bag of fertiliser and one bag of maize seed. Lack of awareness seems to be explained by the fact that, in three of the four villages, sensitisation activities were implemented through village heads rather than by AEDOs with the community as a whole. Indeed, in village D most of the selected farmers were aware of the criteria because of the meeting organized by the AEDO, though this awareness did not stop favouritism from being reported by all farmers interviewed (see below).

The power and informational asymmetries in turn created scope for favouritism and personal relationships to influence targeting outcomes. A common response by farmers in all four villages was that some element of favouritism was involved, with family favouritism reported by all farmers interviewed in village D, in spite of farmers and MoAFS staff being present when selected beneficiaries were read out. This example highlights the degree and significance of village-level power asymmetries. One farmer explained this by saying *‘there is no room for talking’*, inspiring the title of this article.

AEDCs and district level officers agreed that relationships have an important influence on who receives coupons. Three AEDCs suggested they were *‘extremely important’* and one said it would be difficult to get a coupon without a good relationship with the head. AEDCs and district officers also believed family relationships (*‘chibale’*) were important, with one AEDC explaining heads give coupons to relatives *‘a lot, a lot, a lot’* as he has had to subsequently reason with village heads to encourage a fairer distribution. These

and other divergences from formal guidelines were suggested by the AEDC and other MoAFS staff to particularly occur where the village head is ‘strong’.

Given the above findings, it was unsurprising that one of the most common findings from the interviews concerned how the current targeting system is leading to considerable enmity within villages.

Community politics

‘There was a lot of fighting, pulling each other, between me and the villagers, because everyone wants to benefit and there are few coupons, people link the coupon programme to other programmes, like making roads and community gardens. People say “how come you used us for that development activity and now we are not getting a coupon?”’ - Village head

In spite of the power and informational asymmetries between village heads and ordinary villagers, it was evident that the heads were subject to a range of competing demands from community members. So, while relationships were reported to be important, one AEDC noted that heads were not always able to show complete favouritism as there could be pressure on them from those involved in development activities who can threaten to withhold future involvement. Another AEDC explained *‘Some are not happy, even though they are better off, they would like to receive a coupon. They say “I am involved in community projects so I should receive one”’*. One AEDC also referred to a few cases where villagers had stopped the decision-making process and torn up the beneficiary list because they felt the decisions were unfair.

The idea of pressures to share subsidies also came out among MoAFS staff explaining the ‘village politics’ that sometimes takes place, of sharing between clans. One district officer even mentioned *‘Sometimes it is working better where there are many clans in order to avoid coupons going to one clan... Majority rules.’* Another said, *‘There are village politics attached- everybody likes to think they are poor.’*

It was also mentioned by one of the district level officers that sometimes people can pay individuals involved in coupon distribution beforehand in order to access coupons.

5.5.2 Redemption of coupons and access to inputs

Table 17 provides information on coupons received (some of which were to be shared with other households). While the majority were reportedly used to buy inputs, just over 20% were not redeemed, all of them fertiliser coupons. The majority of these were reportedly sold, the reason given in all cases being that fertiliser was not accessible at the local depot. Of the others, one held by an elderly lady was stolen by someone in the queue at ADMARC who had taken payment from her to help her redeem it. The other was given to the village head and never returned after its owner was unable to redeem it.

Interestingly, despite it being played down by a number of researchers, the issue of non-redemption came at the very top of the concerns of both district level MoAFS officers. Among all interviewees, key factors reported to determine use of coupons emerged at the level of the beneficiary, the local-level and macro-level.

At the level of the beneficiary, the most commonly suggested reason for non-redemption was lack of access to money. Farmers and MoAFS staff noted that poverty can be a strong determinant of whether a beneficiary chooses to sell a coupon. It was mentioned in a number of cases how the poorest were particularly vulnerable to selling coupons because of the need to access cash for food and other items, especially if there was a long gap between getting a coupon and being able to redeem it.

On the whole, however, farmers generally seemed reluctant to sell coupons and, when asked how much money they would accept as payment for a hypothetical fertiliser coupon given to them in November, the majority could not imagine doing so because they knew it was better to use the inputs. This majority were all women. One said, *'In the first place, I would not sell a coupon. It is like killing yourself because, as you can see, I am very poor and there is nowhere I can get money, so the only way is to rely on subsidised inputs'*. Another pointed out it did not make sense economically, because to buy a 50kg bag of fertiliser would cost them 17,000 MWK (around US\$ 53). Of the respondents who could imagine a price for selling a coupon, all were male. One of them did actually sell his coupon for 6000MWK (US\$ 18.75) due to an expected inability to redeem it. The idea of men being more willing to sell coupons was supported by the views of an AEDO who said, *'Men are less responsible here. If they get a coupon they will go and not use it properly'*.

A range of local level factors also came up as playing a key role in influencing the ability to redeem coupons at the parastatals. The two most common ones are discussed. Firstly, across all villages it was reported by farmers, village heads, AEDOs and AEDCs that

there were ‘vendors’ involved who buy and sell coupons and subsidised inputs. In general, these are local businessmen, some of whom own small agro-dealer outlets. A number of farmers and heads explained how vendors occupy positions at the front of the queue at the fertiliser depot at the time beneficiaries redeem coupons, restricting access. It was frequently commented how they have close working relationships with ADMARC officials, allowing them to access subsidised inputs. When asked how this could happen, one AEDC explained you do not need identification to redeem coupons if you have money to give ADMARC staff. Another AEDC echoed this, explaining he had confiscated fertiliser found on non-beneficiaries and suggesting that out of 300 bags as much as one third could go to vendors. An account by one AEDO described how he had known of a truck that dropped off inputs to vendors through an agreement with the team leader of the local ADMARC depot. Farmers from different villages explained how vendors would sometimes come to ask people if they wanted to sell coupons and an AEDC explained how vendors get coupons from the poor, acquire the inputs and then re-sell them at below market prices. Among farmers, village heads and MoAFS staff up to AEDC level, over half reported buying and selling of coupons to be either ‘very common’ or ‘fairly common’ in their area.

Secondly, across all villages there were reports of top-up prices being hiked well above the official level. Payments reported to have been asked for either by ADMARC officials or vendors ranged from between 1500 MWK (US\$ 4.69) to 3500 MWK (US\$ 10.93) per coupon. Of the villagers who reported accessing subsidised inputs, a third reported paying a ‘tip’ to vendors and an ADMARC employee of between an additional 1000 MWK (US\$ 3.13) and 3000 MWK (US\$ 9.38). Interviews from village C suggested that the use of community policing in 2012/13 helped to prevent bribes reportedly requested by local police at depots the year before.

Macro-level factors influencing supply of fertiliser to local levels and therefore access, were also mentioned, particularly in interviews with MoAFS staff. Specific emphasis was made relating to challenges of timing in terms of getting inputs out before the rains started when some areas become impassable. A second key macro theme was the large-scale leakage of fertiliser from district-level or above, specifically involving private transporters. One district level officer explained how in 2012/13 more than ten trucks containing 4,000 bags of fertiliser (200mt) had been diverted in this way. This appears to have been part of a bigger problem in 2012/13, with the Logistics Unit aware of a total of 608mt of fertiliser lost or stolen in transit (Dorward et al., 2013: 11). While this represents

only 0.4% of the overall 150,000mt procured for 2012/13, the district level officer explained that because of the fixed budget, no new fertiliser was arranged to replace the missing bags. This means that, based on the level of diversion that was known about, at least 12,160 coupon holders lost out on access to subsidised inputs, with substantial implications for the livelihoods of them, their families and the wider local economy.

5.5.3 Use of subsidised inputs

The final stage of the transmission process studied was factors influencing use of subsidised inputs. All beneficiaries who reported successfully acquiring subsidised fertiliser reported sharing it with other households based on the sharing arrangements mentioned earlier. The only cases of recipients reporting to have not shared inputs were among farmers in village B and for maize seed only. After sharing, all farmers claimed to use their remaining share of inputs on their own land, except one farmer who reported eating his legume seeds (groundnuts) out of hunger.

In general discussions regarding the resale of inputs (as opposed to coupons), the common view was that among genuine beneficiaries it ‘never happened’ or was ‘fairly uncommon’ as inputs are highly valued and hard to come by. Most farmers said that if they can access fertiliser then they would use it on their own land. One farmer pointed out that *‘selling is not the best idea – fertiliser helps you produce more maize – selling it is like you are putting yourself into poverty’*. A village head also pointed out *‘people cry for fertiliser, why would they sell it?’* and an AEDC pointed out that *‘here they take it as a blessing because to find fertiliser now, it’s expensive’*.

However, some MoAFS staff, farmers and village heads still reported sale of inputs as ‘fairly common’ or ‘very common’ and there was an acknowledgement among a number of MoAFS staff and farmers that, sometimes, poorer farmers choose to sell a portion of their inputs because of poverty, using the cash for immediate needs. An interesting insight came from one farmer who explained that, while farmers in the area had previously sold subsidised fertiliser because they had no food, since a World Food Programme (WFP) project started distributing free maize in the area, they stopped selling fertiliser.

When farmers were asked to offer a price for a hypothetical 50kg bag of fertiliser given in November, just three respondents said they could imagine selling it, for between 10,000 MWK (US\$ 31.25) and 15,000 MWK (US\$ 46.89). Again, as with those who could imagine selling coupons, all were male.

5.6 Discussion

This final section returns to the paper's core research questions in the context of the above findings and earlier conceptual framework, and asks what we can reasonably infer from the findings. The section considers the study's novel contributions and discusses policy implications. First, some limitations of the study are considered.

5.6.1 Limitations of the study

One of the main limitations of the study is its relatively small sample size, which limits the extent to which findings may be generalised beyond the areas visited. However, the purpose of the study was not to identify nationally representative results, but rather to investigate and explain in greater depth than before the underlying informal targeting processes and transmission mechanisms, explaining outcomes in a number of specific areas by drawing on the views of a wide range of stakeholders. Nevertheless, some validation of the results can be found through their consistency with quantitative household survey results, as discussed below.

A second limitation is that, despite attempts to build a closer rapport than is possible with large-scale closed-ended household surveys, some respondents may have still been reluctant to disclose the full scale of malpractices. It is also possible that any reports based on hearsay may exaggerate actual events, though care was taken during the interview process to minimise this through triangulation and probing.

Finally, this study has focused on what explains targeting outcomes at the village level. Processes relating to area-level targeting, which crucially influence the amount of subsidy locally available, have remained outside its scope.

5.6.2 Summary and discussion of main findings

Before discussing the findings in relation to existing evidence, it is helpful to briefly synthesise the main findings of the study. The key factors identified as explaining targeting outcomes are summarised in Table 18.

Table 18: Summary of key challenges relating to targeting outcomes

Stage of the subsidy allocation-use process	Key factors explaining targeting outcomes
Selection of formal (and informal) beneficiaries and coupon allocation ³⁵	<ul style="list-style-type: none"> • Concentration of decision making power in hands of village heads • Limited community awareness of selection criteria and beneficiary entitlements and limited participation in decision making • Role of community politics in mediating outcomes
Redemption of coupons and access to inputs	<ul style="list-style-type: none"> • Lack of local access to subsidised fertiliser due to involvement of unscrupulous vendors who have relationships with depot staff, leading to diversion and hiking of official top-up prices • Lack of access to subsidised fertiliser resulting from leakages within the transport system and logistical supply challenges • Poverty-related constraints to coupon redemption creating incentives for coupon sale, exacerbated by uncertainties arising from other obstacles in accessing subsidised inputs and presence of vendors • Possible gender-related differences in willingness to sell coupons
Use of subsidised inputs	<ul style="list-style-type: none"> • Enforced sharing of inputs within villages driven by village heads • Poverty-related constraints meaning poorer households may sell portions to access cash for basic needs and expenditures • Possible gender-related differences in willingness to sell inputs

Source: Author.

5.6.2.1 Identification of beneficiaries

While open meetings have been encouraged since 2008/09 to sensitise farmers about the operation of the FISP and remove power from traditional authorities including village leaders (Dorward et al., 2013), this study suggests that the mere promotion of open meetings is neither adequate nor sufficient for effective beneficiary identification and selection. In the four separate areas studied, decision-making remained non-participatory and meetings were merely a formality for the village head to communicate decisions that had already been made. This finding supports the hypothesis of Dorward et al. (2013) that open meetings may typically be a place for village heads to communicate decisions that have been made already. The findings shed new light on earlier empirical evidence by Chirwa et al. (2011b) that communities which held open meetings had an improved allocation to households ranking themselves as poor by 10% compared to areas where no meetings were held. Findings from the present study indicate that rather than it being the

³⁵ The formal and informal distinction refers to how selection of formal beneficiaries was linked to agreements orchestrated by the village head on sharing with other households.

open meetings themselves improving outcomes, these villages may have simply been areas in which the village head felt inclined to at least hold a meeting, reflecting instead the role of pre-existing power asymmetries and other local contextual features.

The findings are consistent with and help to explain evidence from the 2012/2013 Farm Input Subsidy Survey presented in Table 15, which showed that while over 70% of respondents reported the existence of an open meeting, 72% of respondents also suggested it was village heads that decided on who received fertiliser coupons. This study helps explain that apparent contradiction. The findings of elite capture, favouritism and village politics are also consistent with the quantitative analysis by Kilic et al. (2013), which found that having a village head, VDC member or traditional authority in one's household network increased the probability and number of coupons received in 2009/10. They also fit with previous research on Malawi indicating that neo-patrimonialism and social relationships characterised by inequality and a large 'power distance' are common features within the country's political economy (Booth et al., 2006).

The interviews found that a further explanation for how weak targeting outcomes can arise is that there were low levels of awareness among ordinary villagers about the official criteria, entitlements and procedures for selection due to the gatekeeper role played by the village head, who can restrict access to information. This finding contrasts with earlier findings from a qualitative evaluation of the 2010/11 season (Mvula et al., 2011). This could be an artefact of the areas visited and farmers interviewed, though it was a common finding in three of the four villages. An alternative explanation is that the individual semi-structured interviews used were able to elicit concerns of more marginalised individuals which may not have emerged in the study by Mvula et al. (2011), which drew heavily on FGDs and interviews with village heads for the question of awareness of targeting criteria.

As per the conceptual framework (Figure 15), key reasons explaining the observed outcomes can be found in the interactions between local contextual factors and programme design. Contextually, the position of, and deference to, traditional authorities within the rural Malawian setting is crucial, as highlighted in various quotes cited above, including reference to the village head as the '*owner of the village*', how there was '*no room for talking*' and how '*ordinary villagers cannot go to the government without going through the village head*'. This fits with previous research highlighting the importance of cultural reverence to traditional authorities in Malawi (Chirwa et al., 2012). It also helps to explain the findings of favouritism and the suggestion by MoAFS staff that relationships and family ties can be particularly important, especially where the village

head is *‘strong’*. While this contrasts with findings by Turley et al. (n.d.), who found little evidence to support any elite capture or to suggest that greater power of a local leader was associated with increased elite capture, the present study provides evidence in the context of a longstanding national government programme, and so is less likely to be subject to an observer effect.

However, the study also found that, in some places more than others, this power might be mediated by demands on local leaders. For example, where people hold power through providing labour or services to the village, they can threaten to withhold it. In addition, it was suggested by MoAFS staff that *‘Sometimes it is working better where there are many clans in order to avoid coupons going to one clan’*, consistent with findings of a study by Acemoglu et al. in Sierra Leone (2014).

In Malawi’s FISP, the position of local leaders interacts with programme design and implementation features leaving it somewhat flexible as to how beneficiary selection should actually take place. While village heads are formally supposed to ‘provide support’, the findings showed how some extension officers were happy to allow village heads to exercise their traditional authority and there appeared to be no consistent determined effort to impose alternative structures to counteract the influence of traditional authorities, as in Malawi’s Social Cash Transfer Programme (SCTP). A further important contextual explanatory feature of the areas visited was that agricultural extension staff were responsible for covering, on average, 30 to 52 villages (Table 16). It is not clear whether the fact that the two more remote villages were also those where favouritism was reported (consistent with Pan and Christiaensen (2012)) was related to this or not. Further qualitative fieldwork covering a larger number of villages would be useful in this regard. However, the fact that favouritism was consistently reported in Village D despite the extension officer facilitating a meeting indicates that such oversight and monitoring alone may be insufficient to counteract the power of village leaders in Malawi.

The above factors also help explain the other observed outcomes, including: wealthier households getting coupons and even getting higher proportions; village heads seemingly being able to access coupons for themselves (consistent with Kilic et al. (2013)); and village heads exhibiting family and other favouritism, sometimes to the detriment of genuine beneficiaries.

5.6.2.2 Access to inputs

The study found systematic involvement of vendors across the areas visited and close relationships and collusion with depot staff, fitting with a previous programme evaluation from 2010/11 that found vendors purchased inputs from traditional leadership or agricultural officials (Mvula et al., 2011). The study also supports the quantitative programme evaluation data, which suggested that lack of stock was a crucial obstacle preventing coupon redemption (Table 15). Crucially, however, the findings support a previous hypothesis by Mvula et al. (2011), linking vendor involvement to stock-outs. Additional findings supported by previous research include findings of secondary markets for coupons (Holden and Lunduka, 2012b) and the demand for ‘tips’ for coupon redemption, reported as ‘common’ in a quarter of the life stories recorded in Mvula et al. (2011).

Looking further at what seems to explain the findings, two key interacting features emerge particularly strongly. Firstly, the FISP’s design in 2012/13 saw parastatals exercise an effective local monopoly for subsidy coupon redemption, generating strong power asymmetries between depot staff and coupon holders. This appears to be played upon by depot staff and vendors, able to use their position and fear to extract rents and capture coupons. This is reinforced with the contextual feature of widespread poverty and a lack of empowerment, which also creates incentives, particularly among poorer households, to sell coupons, especially in areas where there is risk and uncertainty over being able to redeem coupons for fertiliser.

5.6.2.3 Use of inputs

In terms of subsidised input use, the findings are consistent with previous evidence of splitting coupon packages (Chirwa et al., 2011b, Mvula et al., 2011), but go beyond this by highlighting the crucial role that village heads can play in shaping input use, in so far as the selection of formal beneficiaries was linked to agreements arranged by the head for these beneficiaries to share inputs with other informal beneficiary households. It was found in village D how this process of making formally registered beneficiaries share with others can even be used to cover up enforced sharing with those favoured by the village leader.

Key factors that explain this are, again, related to programme design and contextual factors. Firstly, Malawi is a country in which there are a very high number of potentially

eligible resource poor households. The poverty rate is around 56% in rural areas (NSO, 2012), making it difficult to distinguish between poor households for targeting purposes in the FISP given the very broad criteria. The fact that the programme in 2012/2013 aimed to formally target approximately just one third of households (with a full package) in each village, appears to have therefore encouraged sharing of inputs in a context where village leaders and local politics play such a central role in beneficiary selection, with minimal scope for effective oversight and enforcement.

The other main finding, of poorer households being potentially more prone to selling a portion of their fertiliser, offers a new insight into subsidised input use within the FISP.

5.6.3 Implications for theory and policy

As well as contributing to the literature on the FISP, this study also contributes to the wider literatures on decentralised targeting, elite capture and rent-seeking. Firstly, the study reinforces the findings by Pan and Christiaensen (2012) and others that resource allocation in certain settings can end up being driven by and reflecting the preferences of elite groups. More specifically, the study provides evidence that this may be likely to particularly occur in contexts where there is:

- a) strong cultural reverence to local leadership structures and/or power asymmetries between those with access to the resources being distributed and potential beneficiaries;
- b) limited administrative or cultural scope for government oversight or intervention; and
- c) where the design of the programme or policy itself leaves the targeting mechanism guidelines and eligibility criteria very broad, with a high proportion of potentially eligible beneficiaries.

Nevertheless, elite capture at the village level was not found to translate into complete capture of resources, as targeting outcomes appeared to reflect some attempt at spreading resources in a way to maintain local support, or to avoid local conflicts, and/or reward familial or friendship ties.

In terms of rent-seeking, the case of the FISP seems to underscore the particular danger for rent-seeking and diversion to take place, not just where there are power asymmetries between beneficiaries and those involved in distribution, but where there is a particularly

high differential between the subsidised price and the market price, leading to incentives for capture and re-sale on secondary markets as has been found elsewhere, such as in India's public distribution system (Davala et al., 2015).

Overall, the findings highlight the utility of the earlier conceptual framework (Figure 15), which emphasises the crucial importance of interactions between local context and design features in determining targeting outcomes under CBT.

From a policy perspective, four main implications arise, relating to the choice of subsidising inputs compared to other options, choice of targeting criteria, beneficiary selection and redemption of subsidy coupons.

On the first point, given the substantial challenges identified at various stages from beneficiary selection to coupon redemption and use of subsidised inputs, the findings raise the question of whether an alternative approach of providing direct cash transfers may be a more efficient means of achieving the FISP's objectives. Such an approach would help to avoid the challenges associated with coupon redemption, secondary markets (for coupons and subsidised inputs) and crowding-out of private sector input suppliers. However, targeting outcomes would still crucially depend upon the targeting mechanisms used. The provision of cash transfers over subsidised inputs would also open up the possibility that transfers were used for alternative goods and services (e.g. livestock), unless they were made conditional upon purchasing subsidised fertiliser, though monitoring and enforcement mechanisms would be challenging to implement. Therefore, while cash transfers could potentially represent a more efficient approach, it could end up prioritising the achievement of household food security (among beneficiaries) over national self-sufficiency in maize production.

Regarding targeting criteria, the study finds some support for the proposal by Matita and Chirwa of more narrowly targeting subsidised inputs to households unable to afford commercial fertiliser but most able to effectively use it, while targeting the very poorest with cash transfers (Matita and Chirwa, 2014). One of the reasons for this is that, aside from helping address the sale of coupons and subsidised inputs identified to take place partly among some of the poorest, it would also ensure those that do receive inputs were better able to realise longer-term livelihood-related benefits. Such an approach is in fact planned for the 2015/2016 season, with vulnerable households to be removed as target beneficiaries and a shift towards considerably higher top-up payments. However, the

crucial challenge will be to ensure that poorer households (nearly all of which also rely on agriculture for their livelihoods) are still able to access affordable inputs, which is unlikely given the low levels of cash transfers and high market prices for inorganic fertiliser. Otherwise the move will represent a considerable step backwards in terms of promoting socio-economic equality in Malawi and is likely to lead to major food insecurity among poorer households.

Regarding selection processes, the findings indicate that without effectively curtailing the power exercised by village leaders, targeting outcomes will likely continue to diverge from policy intentions. Furthermore, this study and evidence from FGDs suggests that, rather than building social capital, the current targeting approaches being promoted are leading in many cases to resentment and enmity (Dorward et al., 2013: 89). As attempts to introduce open forums appear to have failed to effectively curtail the dominance of village leaders in the areas visited, one option would be to adapt lessons from the targeting approach used in Malawi's SCTP, which has shown a greater commitment to establishing and training independent selection committees (Community Social Support Committees). Nevertheless, this has not completely removed the ability of local leaders to still influence beneficiary selection (Handa et al., 2015), including where their relatives become committee members. A further benefit of the SCTP targeting approach is that, alongside CBT, it is combined with a proxy means test applied at the district level, which again can go some way to counter-balance the influence of local leaders. As mentioned earlier, a cross-country study by Coady et al. (2004) indicated that combined CBT approaches had worked well on average in the past. Furthermore, significant cost savings could be made if targeting costs could be shared between the FISP, SCTP and other social protection measures.

One alternative to CBT involves implementing a smaller rationed universal subsidy among all smallholder farmers (Dorward and Chirwa, 2013b, Holden and Lunduka, 2012b). For example, Dorward and Chirwa have discussed universal provision of a 50kg bag of fertiliser as 'effectively legitimising and extending the widespread practice of redistribution' (Dorward and Chirwa, 2013b: 10-12). Some of the main benefits of such an approach have been highlighted elsewhere (SOAS et al., 2008) and include:

- increasing access to fertiliser among the poor by eliminating exclusion errors or undercoverage;

- increasing transparency and accountability (providing everyone knows of their entitlement, which this paper suggests would be a challenge); and
- eliminating the costs and difficulties of targeting.

In contrast to the earlier universal programmes mentioned in the introduction, a rationed universal subsidy would restrict the amount of subsidised inputs available per household, restrict the inputs to smallholder farmers only and could impose a maximum duration of subsidy support. Universal programmes need not be prohibitively expensive; a recent review of nine AISPs suggests average programme costs per mt of fertiliser distributed were around 20% lower for universal as compared with targeted input subsidy programmes (Jayne and Rashid, 2013).

While a rationed universal subsidy would require trade-offs in terms of a smaller package per beneficiary, given existing sharing arrangements and inequalities in the amount of subsidy accruing to different wealth groups (Harman et al., 2015), resource poor households may well receive more than they do at present. Also, while there would be some increase in less-poor households getting inputs, if fertiliser coupons from 2012/2013 were distributed evenly among all wealth groups, overall, the total quantity of fertiliser going to less poor households could remain at a similar level or even decline.³⁶

However, some important issues would require further analysis before implementing a rationed universal approach. Firstly, whether the smaller input package per recipient household would realistically be enough to allow for graduation and a permanent shift out of poverty and the ‘maize dependency trap’ (Chirwa and Dorward, 2013a). Secondly, whether it would increase or decrease crowding-out of commercial fertiliser sales. Thirdly (and relevant to all targeting approaches), success would crucially depend on developing and maintaining an accurate list of farm households and the effective introduction of national identification cards.

An alternative to CBT and the rationed universal subsidy is a pure PMT approach that would identify beneficiaries using a small number of observable socioeconomic indicators (e.g. housing characteristics, land and asset ownership). This could be combined with categorical targeting through household assessments to ensure that cash transfer alternatives were provided to households unable to engage in agricultural production. Regarding the PMT component, some proponents have argued that, while it would involve considerably higher administrative costs, it could reduce errors of

³⁶ Calculations are available upon request.

exclusion and inclusion without necessarily becoming cost-ineffective (Houssou and Zeller, 2011). However, it must be recognised that ‘there are potential major costs and challenges in gathering accurate and reliable data on household indicators and in ensuring that these indicators are used properly in the processes of subsidy allocations to households’ (Dorward and Chirwa, 2013b). For example, while it has been suggested that data could be collected as part of the annual update of the farm household registry (Kilic et al., 2013), interviews with MoAFS staff highlighted considerable problems and reliability issues even simply updating the farming population (see footnote to Table 16). Furthermore, it has been noted how households have been known to give misleading information on indicators if they believe it will improve their chances of receiving transfers (Abdoulayi et al., 2013). Indicators would therefore need to be selected extremely carefully to minimise the scope for misreporting.

One way of reducing the cost of PMT targeting would be to spread the costs with existing social protection programmes, such as the SCTP (Matita and Chirwa, 2014), by developing a single registry of all households below a certain socioeconomic threshold. This approach has been used in many successful conditional cash transfer programmes, where the same household targeting systems are used for various programmes even with different criteria and thresholds, seen by some to constitute major ‘institutional capital’ for the countries concerned (Fiszbein and Schady, 2009: 70).

Finally, the study has highlighted the need to overcome the substantial challenges in accessing subsidised fertiliser. Crucially, this involves tackling the secondary market that exists for coupons and removing power from parastatal depot staff and unscrupulous vendors. Interviews from village C suggest that the use of community policing could go some way to tackle the problem and more effective communication campaigns of grievance mechanisms available to report malpractices could also prove useful. A potential step forward in tackling the above challenges is currently in place for the 2015/16 season, through plans to privatise the procurement and distribution of fertiliser for use in the FISP. In so far as this removes the stranglehold on subsidised fertiliser access that has been held by parastatal depot staff and introduces some competition at a local level, this could help address the problem of fertiliser coupon redemption. However, in some areas private outlets may retain an effective monopoly and careful attention will need to be paid to ensuring private outlets stock sufficient fertiliser at the right time (even though there would be a profit incentive for them to do so). Moreover, the late delivery of subsidised fertiliser in 2015/16 also highlights the continued challenges associated with

government commissioning of contracts for subsidised inputs, raising the question of whether a more purely private sector led approach would be more beneficial.

5.7 Conclusion

This study set out to identify the key underlying factors driving and influencing outcomes at various stages in the transmission of subsidised agricultural inputs to beneficiaries in Malawi's FISP. It did this through gathering new primary data from a wide range of stakeholders covering four separate localities in the central and southern regions. The findings reveal that power and informational asymmetries play a crucial role in influencing targeting outcomes and the redemption of subsidy coupons, with local leaders, depot staff and vendors all occupying positions of authority that can permit the extraction of rents and distribution of patronage, ultimately restricting access to subsidised inputs among intended beneficiaries. Poverty was also identified as an important factor that can work against farmers redeeming their coupon or using all of their inputs. Addressing these power imbalances and opportunities for rent seeking as well as providing alternatives for the poorest households unable to engage in productive agriculture were identified as key priorities for a more cost-effective and efficient FISP. Using the case of Malawi's FISP, the study contributes to the literatures on decentralised targeting and elite capture, providing evidence which supports the theoretical dangers of elite capture and displacement of official programme targeting criteria under a specific form of CBT, in a specific local context.

Preamble to research paper three

The previous two chapters have focused on the issue of targeting in the case of an AISP. The next and final empirical chapter continues with the theme of targeting, but from a different angle and within the context of a PHPS programme. The chapter looks at whether or not the Tanzanian National Voucher Scheme for mosquito nets crowded-in or crowded-out demand for unsubsidised nets.

The chapter is based on a research paper written to address research objective three of the thesis – *to estimate the impact that the TNVS had on commercial ITN sales and overall ITN coverage between 2005 and 2008* – and which is currently under submission to Health Economics.

As with Chapter 4, the impetus for the study and its study design are informed through a cross-sector approach, this time drawing on the heavy emphasis placed on the issue of crowding-out in the AISP literature. While the issue has been recognised within the PHPS literature it has received less attention and there are very few studies focussing directly on the effect partially subsidised PHPs have on unsubsidised sales. Drawing on approaches used in the AISP literature, a household demand model is estimated econometrically using non-linear multivariate regression methods and nationally representative household survey data covering 6,918 households.

Luke Harman designed the study, collected and analysed the data, and drafted the paper. Professor Andrew Dorward and Dr Catherine Goodman provided advice and support throughout the research process, including comments at the drafting stage.

6 The Impact of Voucher Subsidies for Mosquito Nets on Incremental Net Coverage in the Tanzanian National Voucher Scheme

Abstract

This paper uses a household demand model, estimated econometrically using a range of estimators and a nationally representative household survey, to calculate the extent of any crowding-in or crowding-out in Tanzania's National Voucher Scheme (TNVS) for mosquito nets. The results provide robust evidence that, between 2004 and 2008, the receipt of partially subsidised nets reduced the purchase of future unsubsidised nets. Estimates suggest that, on average, every 100 subsidised nets led to an incremental increase of between 88 and 90 new nets. The reduction in the purchase of unsubsidised nets was considerably higher among the wealthiest households, suggesting that the receipt of subsidised nets displaced unsubsidised sales that would have gone ahead in the subsidy's absence. However, the same effect also occurred among the bottom four wealth quintiles, indicating that wealth may be an imperfect determinant of demand for ITNs and that factors, such as high unsubsidised ITN prices, may have prevented the TNVS from crowding-in future unsubsidised purchases. Furthermore, incremental coverage may have been even lower than the estimates suggest if there was substantial diversion of coupons away from receipt by intended beneficiaries (which would not be picked up by the household survey data). There is some evidence to suggest such diversion took place. The study's findings highlight how, due to the impact a public health product subsidy programme can have on unsubsidised sales, it must not be assumed that such programmes lead to a one-for-one increase in overall coverage and use, and raise the important question over whether long-term efficiencies could be gained by using alternative targeting approaches and taking complementary steps to lower commercial prices.

6.1 Introduction

The subsidisation of public health products (PHPs) has become a popular and increasingly common policy in low-income countries as a means of tackling major public health concerns such as malaria. The basic idea behind subsidising such products is that by reducing their market cost, their coverage and use may be rapidly increased, thereby improving the health of a population. The justification is further reinforced where the products address communicable diseases given the wider social benefits of assuring private health (Dupas, 2014).

It has also been argued that, subsidising products may provide an opportunity for individuals to experience the benefits of their use, either directly or via social learning, thereby promoting or ‘crowding-in’ future purchases (Dupas, 2010). By stimulating increased demand, recent thinking has suggested that this ‘demand-side financing’ approach may also help to pump-prime private sector supply chains, thereby laying the foundation for sustainable future access to PHPs (Roll Back Malaria, 2005).

However, another strand in the literature suggests that the provision of subsidised products may, in certain circumstances, ‘crowd-out’ commercial provision of the same products. For example, if subsidised products reach those that would have purchased the product commercially anyway (Hanson et al., 2001), or from any inflationary impact that increased aggregate demand may have on the market price of unsubsidised equivalent products (Gingrich et al., 2011a).

Despite theoretical claims that subsidies may either crowd-in or crowd-out unsubsidised purchases, to date there has been very limited empirical research looking into the effects of partially subsidised PHPs on demand for unsubsidised equivalent products, with Carneiro et al. (2012) concluding that there are few examples from ‘developing countries’ in the literature. Hanson et al. have previously noted that one reason for the lack of empirical research may be due to research and policy priorities, saying that ‘The potential for this “crowding out” of the private sector has traditionally received less weight than concerns for increasing access’ (Hanson et al., 2001: 129). The gap that this represents is a problem, however, as it leaves important unanswered questions over the impact that subsidy programmes are having on raising the incremental coverage of health products.

This study contributes to the limited empirical research on the effect PHP subsidies have on unsubsidised commercial demand, looking specifically at the case of the Tanzanian National Voucher Scheme (TNVS) for insecticide-treated mosquito nets (ITNs). It is the

first that the author is aware of which uses a household demand model to estimate the impact of partially subsidised mosquito net purchases on purchases of unsubsidised mosquito nets.

The following section provides a conceptual background to the issue of crowding-in and crowding-out before section 6.3 reviews the existing evidence. Section 6.4 then describes the TNVS in the context of Tanzania's experience with ITNs and section 6.5 sets out the methods used in this study. Section 6.6 reports the results before section 6.7 concludes by discussing the main findings and policy implications.

6.2 Crowding-in, crowding-out and displacement

The concept of crowding-out is a long-established one in the Public Economics literature, referring to a situation where the public provision of a good or service has a negative impact on the private provision of the same or a substitute good or service (Abrams and Schitz, 1978). More recently, the idea has been applied in the context of agricultural input subsidy programmes (AISPs), with a growing number of studies investigating the impact of fertiliser subsidies on unsubsidised fertiliser purchases (Liverpool-Tassie, 2012, Ricker-Gilbert et al., 2011, Takeshima et al., 2012, Xu et al., 2009). Within the AISP literature, the main mechanism through which crowding-out is thought to take place relates to targeting. Specifically, if a government subsidy goes to an individual who would have already purchased the product in question at a commercial price and the subsidy discourages them from making a commercial purchase then the subsidy is considered to have crowded-out the unsubsidised purchase (Ricker-Gilbert et al., 2011).

What has not been well discussed in the AISP literature, however, is the conceptual distinction that should be made between crowding-out and displacement. Whereas crowding-out typically refers to the idea of a subsidised government good or service taking the place of one in the private sector, with a negative effect on the private sector, if the subsidised good or service is itself being delivered *through* the private sector, it may make more sense to talk of a displacement effect. That is, the subsidised good or service takes the place of the commercially provided one, but without the negative effect on the private sector. However, where certain private retailers are not involved in the subsidy distribution, a subsidy programme may still crowd-out purchases that people would have previously made from them.

A second dimension to the crowding-out versus displacement distinction relates to the impact a subsidy has on individual preferences. If the effect is simply for people to choose to purchase a subsidised product (from a commercial retailer) instead of an unsubsidised one, but then revert to purchasing unsubsidised products in the future, this may be better termed displacement. By contrast, if the subsidy reduces an individual's willingness to purchase unsubsidised equivalent products in the future, this would be better termed crowding-out.

This distinction has not been well defined in the PHPS literature and so in what follows below the term crowding-out is used as a general term, though the term displacement is used where reference to it is specifically intended.

The degree of crowding-out (or displacement) is in turn recognised to have important implications for the impact that a subsidy has on incremental ownership or use of the product as, if one unit of subsidised product simply replaces one unit of an equivalent unsubsidised product that would have been bought in the subsidy's absence, it cannot be said that the subsidy has led to an incremental increase in ownership. In such a scenario, while the subsidy recipient will benefit, the targeting outcome effectively becomes a transfer from the funder to the recipient, which is unlikely to raise overall welfare as much as if it led to an incremental increase in coverage of the product.

Within the PHPS literature, the targeting pathway to crowding-out has also been acknowledged (Hanson et al., 2001, Roll Back Malaria, 2005), though rarely given much attention in practice due to an overriding concern with achieving rapid improvements in public health. Gingrich et al. (2011a) have suggested that a large scale subsidy programme may also discourage unsubsidised commercial sales though raising prices of unsubsidised products. Using a partial equilibrium framework, they estimate that widespread increases in demand for ITNs arising through the TNVS led to retailers raising their prices, which the authors argue 'crowded-out' sales among those who did not get a subsidy (Gingrich et al., 2011a). However, according to the same neoclassical supply and demand framework used, increased prices should in theory only hold in the short-run until suppliers respond by increasing supply.

Crowding-out is often thought of in the context where there is some existing level of private sector commercial supply and demand. However, it is important to recognise that a large-scale subsidy may also crowd-out entry of private sector retailers into the market, which could limit access and lower competition (Hanson, 2004). Such crowding out is more difficult to investigate and has so far received little attention in the literature.

As the above distinction between crowding-out and displacement indicates, the implications of crowding-out will differ depending on whether the private sector is involved in the sale of subsidised products or not. If it is, any resulting displacement may simply shift profits away from unsubsidised commercial sales to subsidised sales. The loss in this scenario is borne by the funder and society in that there could have been greater incremental coverage achieved with better targeting.³⁷ However, if the private sector is not involved in selling subsidised products then it may be more appropriate to talk of a crowding-out effect, if it involves the active undermining of the private sector through taking sales away from it.

While fears of crowding-out have tended to dominate in much of the economic literature, one of the recent arguments in favour of targeted health and agricultural subsidy programmes is that, if implemented correctly, they may instead help to crowd-in unsubsidised sales. There are different possible mechanisms through which this may take place. Firstly, by guaranteeing certain levels of demand a large scale subsidy programme that involves the private sector may help reduce the average fixed costs faced by private firms, thereby allowing them to establish themselves and potentially attain economies of scale (Roll Back Malaria, 2005, Xu et al., 2009). In so far as this leads to increased access and affordable commercial prices, this could help crowd-in future commercial purchases.

A second crowding-in mechanism may operate via the process of allowing beneficiaries to experience the benefits of particular products, providing that the experience demonstrates lower non-monetary costs (side effects) than individuals had anticipated (Dupas, 2010). Dupas also argues that where the benefits of using subsidised products are observed by non-beneficiaries, crowding-in may occur through social learning effects.

Carniero et al. (2012) argue that even the act of a government subsidising a product may help encourage demand by altering beliefs held about the returns to private health investments. For example, indoor residual spraying could raise awareness of malaria and have the effect of crowding-in private sector purchases of goods such as mosquito nets, which are normally considered substitutes.

These various mechanisms aside, there is a recognition that subsidies may not necessarily lead to such effects. This may happen, for example, if the subsidy leads to an ‘anchoring’ or ‘entitlement’ effect whereby individuals come to value the products at subsidised price

³⁷ Of course, even a transfer to an individual who would have already made a commercial purchase will increase their disposable income, which may then be used to purchase other goods in the economy. However, in terms of increasing overall use of the products being subsidised, such targeting outcomes will be sub-optimal.

and are not willing to pay a higher price in the future (Kőszegi and Rabin, 2006, Simonsohn and Loewenstein, 2006, Simonson and Tversky, 1992).

6.3 Review of the evidence on crowding-in and crowding-out

As mentioned already, there has been limited empirical research looking into the effects of partially subsidised PHPs on demand for unsubsidised equivalent products. This section reviews the related evidence as a means of understanding the gaps in the literature. While some studies have looked at the impact of particular health products or services on different products traditionally thought to be substitutes, e.g. (Carneiro et al., 2012), the present study is concerned with the impact that subsidised PHPs have on their unsubsidised equivalents.

The area where most studies have emerged concerning crowding-in and crowding-out relates to ITNs. ITNs were first produced from the 1980s following a number of entomological trials, after which a number of efficacy and effectiveness trials found them to be highly effective both at protecting those sleeping underneath them and in the same house and, when coverage levels are high enough, even those in the wider community (Hawley et al., 2003, Lines et al., 1987, Magesa et al., 1991, Schellenberg et al., 2001). It is now known that regular use of ITNs in Africa reduces overall child mortality by around 20% (Lengeler, 2004). Originally, ITNs had to be dipped in a pyrethroid insecticide once or twice a year to maintain effectiveness. More recently, long-lasting ITNs (LLINs) have been developed which maintain effective levels of insecticide for three years or more even after washing.

The author is aware of only two studies that have looked at impacts of subsidised ITNs on coverage or demand for unsubsidised nets. The first looked at these effects in the context of the previously mentioned TNVS using a partial equilibrium model and estimated that the increased demand for nets brought about by a price subsidy may crowd-out sales by leading to a higher market price for unsubsidised nets (Gingrich et al., 2011a). The authors estimate that, although the TNVS increased overall purchases by around 170,000 nets during the period studied, the increased demand for nets led to a higher price for non-subsidised nets, causing a decline in the number of non-target households purchasing a net from 1.1 million to 769,810. However, while ITN prices did indeed increase, the causal link between increased demand and prices was not adequately proven

in the paper and there are many other sources of potential price increases.³⁸ Furthermore, the same neoclassical theory used would suggest that price increases should only hold until suppliers respond by increasing supply. In addition, the study relied on data covering just one year (2006) and so does not consider dynamic longer-term effects, which are likely to be crucial when it comes to crowding-in and crowding-out, especially concerning durable products such as ITNs that are not purchased with great frequency.

The other study on effects of demand for unsubsidised nets looked at impacts of fully subsidised (free) nets rather than partially subsidised nets, and was based on reported willingness to pay (WTP) rather than actual purchases (Chase et al., 2009). Using a Tobit model, the authors found ownership of a free net to be statistically associated with decreasing demand for unsubsidised nets, suggesting crowding-out. However, in theory the effect of free nets should differ to the effect of partially subsidised nets as while the former should not fundamentally affect a household's budget constraint, the latter will.

Other studies have focused on the impact of free or partially subsidised nets on subsidised purchases (Dupas, 2010, Eze et al., 2014, Gingrich et al., 2011b, Gingrich et al., 2014). An experimental study by Dupas found that the provision of a subsidy of between 40% to 100% on the price of an ITN affected the reported and observed WTP for bed nets in that, one year after the subsidy, WTP was statistically higher in a number of groups who had received the higher subsidy in the first round. However, increases in declared WTP were still well below the market price of the nets, which means it cannot be considered evidence of crowding-in unsubsidised sales. Regression-based analysis using revealed preferences (i.e. the purchase of a second subsidised LLIN) suggested that those who had received free nets in the first round were not less likely to purchase another net. They also found that households were more likely to purchase LLINs when the density of households around them that received a free or highly subsidised net was higher, indicating evidence of social learning effects.

A study by Eze et al. (2014) using a generalised estimating equation model found evidence of free net campaigns being associated with improving redemption rates of subsidy vouchers for ITNs in Tanzania between 2007 and 2011. However, Gingrich et al. (2014) find contrasting evidence using a multivariate Logit model, which suggested that free ITNs reduced demand for ITNs by voucher recipients in the short term. An earlier

³⁸ In an interview with a senior National Insecticide-Treated Nets programme (NATNETS) official from Tanzania, it was argued that the particular price increase in Tanzania was likely to have been strongly associated with the spike in oil prices at the time.

study by Gingrich et al. (2011b) also found that free nets had a negative and statistically significant effect on sales in 2006 through their Logit model estimation on women purchasing subsidised ITNs through the TNVS.

While studies on the impact of free nets on demand for unsubsidised or subsidised sales may be informative, as mentioned above, there are reasons to assume that findings may well be different to the impact of partially subsidised ITNs on demand for unsubsidised ITNs, indicating that further research is needed.

6.4 Background to the Tanzania National Voucher Scheme

6.4.1 Tanzania's history of malaria interventions

Tanzania is one of the most populated countries in Africa, with a population of approximately 45 million in 2012 (National Bureau of Statistics, 2014). With a Gross National Income per capita of US\$ 630 in 2013, it is classified by the World Bank as a low-income country (World Bank, 2013), and in 2012 around 28% of the population were living beneath the national poverty line (World Bank, 2012).

With around 80% of the population estimated to live in areas prone to stable seasonal transmission of malaria, the disease has been one of the leading causes of morbidity and mortality in the country (Donaldson and Thiede, 2011). Given this, considerable attention has been given to various malaria control initiatives in the country.

By the time the TNVS began in October 2004, Tanzania already had a fairly long history of mosquito net use and was an early pioneer in market development for the product. The country was an early testing site for a number of efficacy trials from the early 1980s, which were followed by effectiveness trials from the 1990s (Magesa et al., 2005: 2).

One of the first large scale mosquito net interventions in Tanzania – the Kilombero Net (KINET) project – was a social marketing field trial launched in 1996 that sought to demonstrate the effects of net use on health (Schellenberg et al., 1999). The project used social marketing methods to sell subsidised nets and insecticide treatment kits. KINET ran until 2000 with results showing a correlation between regular use of ITNs and a 27% increase in child survival in children aged one month to four years (Schellenberg et al., 2001). Even at this early stage, there was some limited evidence indicating that the KINET programme may have had a crowding-out effect on unsubsidised sales (Hanson, 2004).

Following KINET a social marketing programme was launched in 1998 by Population Services International with the aim of reducing the negative health impacts of malaria across four specific areas of Tanzania. Called the Social Marketing of Insecticide Treated Mosquito Nets (SMITN), the initiative sought to establish commercial demand for mosquito nets among the Tanzanian population (Hanson and Jones, 2000). Specifically, it aimed to ‘reduc[e] infant and under-5 mortality rates by increasing commercial availability of ITNs and establishing a nationwide culture of ITN use’ (Donaldson and Thiede, 2011: 11). SMITN involved the promotion of a new brand of polyester nets with insecticide treatment, including a heavily subsidised net for pregnant women.

According to one senior official within the National Insecticide-Treated Nets programme (NATNETS), prior to SMITN one could not really talk of a commercial market for mosquito nets in Tanzania.³⁹ However, based on changes in coverage levels from the commercial sector in the different areas being targeted, it appears that there were concerns that SMITN may have had some crowding-out effect on unsubsidised purchases in two of the four areas (Hanson and Jones, 2000, Hanson and Worrall, 2002).

In order to meet the original target of protecting 60% of the population at high risk of Malaria by 2005 as set out in the Abuja Summit of April 2000, a national ITN strategy was endorsed in November 2000 (NATNETS).⁴⁰ The programme was led by the National Malaria Control Programme within the Ministry of Health and Social Welfare. It comprised of three main components (Magesa et al., 2005: 3):

- Increasing demand creation for ITNs;
- Developing a national public-private partnership to build a sustainable domestic commercial ITN market; and
- Targeting subsidies at high-risk groups.

As part of this effort, in 2002 SMITN was renamed SMARTNET and moved away from support for its own subsidised ITN brand - *Njozi Njema* – towards supporting brands from the Tanzanian net industry, allowing domestic net manufacturers to develop their own brands. This was not so feasible before as manufacturers could not compete with the subsidised nets. Agreements were reached so that they would be provided with heavily subsidised insecticide kits if they sold them in a bundle with the nets. Other incentives were also provided to ensure that the private sector reached remote areas, such as transport

³⁹ Interview with senior official in NATNETS.

⁴⁰ The RBM target increased to 80% in 2010.

and storage subsidies to manufacturers and wholesalers (Koot et al., 2006). Retailers were also brought on board by being encouraged to sell nets.

By 2005 the country had no less than four domestic mosquito net manufacturers with a combined total annual net production of over five million nets (Magesa et al., 2005: 9). Aside from the social marketing activities, which have been argued to have ‘encouraged the expansion of the commercial manufacturing and distribution system’ (Hanson, 2004), over time the industry has benefited from a progressively improved tax environment, starting with the removal of a 125% sales tax in 1994 and then Value Added Tax and related import duties by 2004 (Magesa et al., 2005: 6-7). All of this has contributed to a fairly healthy domestic ITN industry which saw the average retail price of Tanzanian nets go down from US\$ 5 in 1995 to less than US\$ 3.50 by 2004 (Magesa et al., 2005: 7).

Another key aspect of the Tanzanian experience has been the on-going communication and marketing throughout society, including the role played by politicians advertising the importance of nets in the media, without which one official within the NATNETS programme believes that uptake would not have been nearly as much as it was, as it has helped to promote a culture of mosquito net use.⁴¹

SMARTNET continued until 2007, overlapping with the TNVS, which launched in October 2004 and is described below. An overview of the various programmes and initiatives, including the key stages of the TNVS is provided in Figure 16.

It is crucial to bear in mind the above context when interpreting the results of this study, as other countries will have quite different experiences of commercial market development for mosquito nets, with important implications for studying crowding-out. For example, where the commercial demand is not so developed, crowding-out of existing private sector sales is likely to be much less of a concern and subsidies may even help crowd-in future unsubsidised sales (Xu et al., 2009).

6.4.2 The TNVS (October 2004 to mid-2008)

As pointed out above, at the turn of the century insufficient demand for ITNs was recognised to be a key problem holding back achievement of the Abuja target. The drive to achieve and exceed this led to what became one of the core initiatives in Tanzania for tackling malaria – the TNVS. This study focuses specifically at the period from the start

⁴¹ Interview with senior official in NATNETS.

of the programme in October 2004 until up to September 2008. This is largely due to data availability but also the switch to subsidising LLINs from 2009 through a one-supplier system led to the effective collapse of the commercial market.⁴²

The TNVS has involved distributing discount vouchers (*Hati Punguzo* in Swahili) to pregnant women on attending antenatal care (ANC) and, from November 2006, children under five attending their first measles vaccination.⁴³ Until late 2009, the voucher entitled the holder to a fixed discount on the commercial price of a conventional mosquito net of their choice at participating retailers, along with a package of insecticide treatment.⁴⁴ Vouchers could be redeemed at participating retailers, entitling the holder to a discount of 2750 Tanzanian Shillings (TZS) (around \$US 2.50), raised to TZS 3250 in January 2007, with any remaining cost paid by the voucher holder as a top-up.⁴⁵ Given average retail prices for ITNs between 2005 and 2006, TZS 2750 represented a subsidy of around 70-90% (Hanson et al., 2008). While *Olyset* branded LLINs were available for commercial purchase from around 2005, LLINs were not available through the TNVS until 2009.

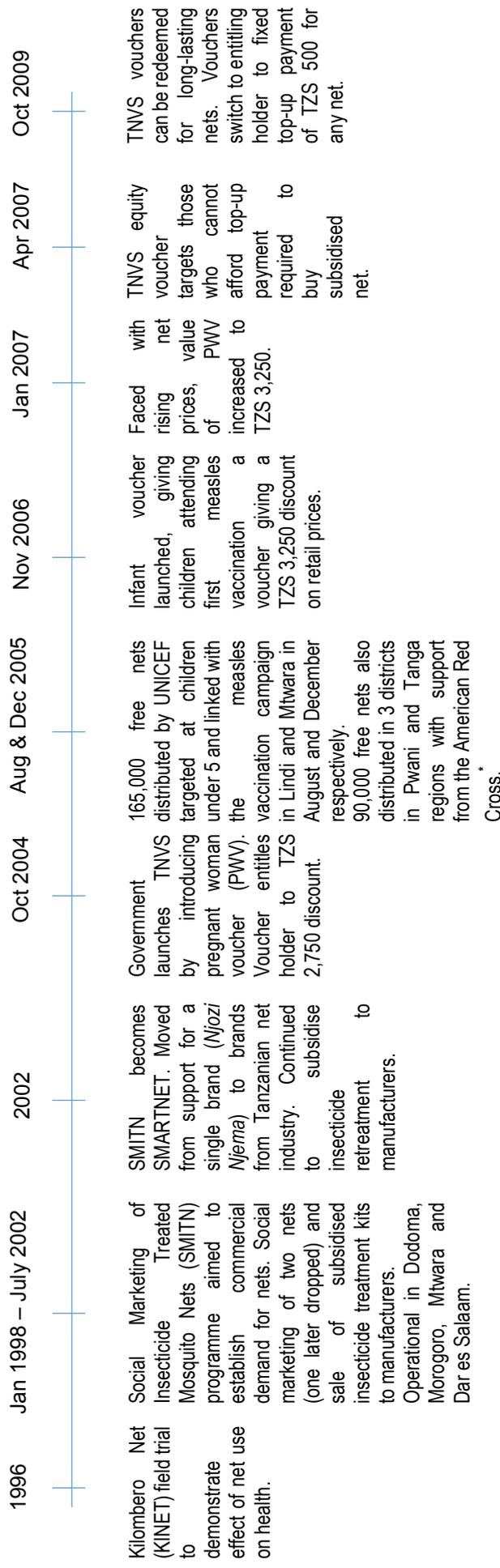
⁴² Interview with senior official from NATNETS.

⁴³ In an attempt to improve targeting towards poorer households who could not afford the top-up payment, an Equity Voucher was piloted in six districts in April 2007 entitling the holder to a free net, though very few vouchers were distributed and evaluations indicated it had a limited effect and so it was not brought to scale (Marchant et al., 2008).

⁴⁴ From October 2009 it changed to a fixed top-up of TZS 500 for long-lasting ITNs.

⁴⁵ Based on an average exchange rate of TZS 1105 to US\$1. October 2004 to May 2006 (Oanda.com).

Figure 17: History of mosquito net interventions in Tanzania



* Included Rufuji district. Pwani was then Coast region. In addition to these there have been a number of smaller scale distributions of free nets by foreign governments, NGOs and research projects.

Source: Author.

Figure 18 shows how voucher books were first distributed by the local logistics partner, MEDA, to District Medical Officers and reproductive and health clinics, where individual vouchers were then given to pregnant women and mothers of infants. Vouchers were then redeemed at participating retailers who in turn exchanged the vouchers for ITNs from wholesalers who could claim ITNs from manufacturers. Manufacturers eventually returned vouchers to MEDA who reimbursed them for the number of vouchers submitted.

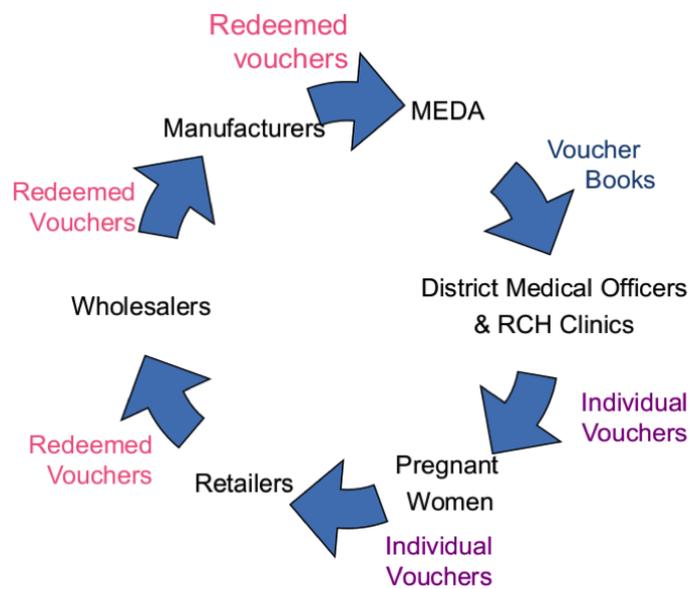


Figure 18: Voucher flow in the TNVS

Source: MEDA

Pregnant Women Vouchers were phased in by district, starting in October 2004, with all districts in the country routinely delivering vouchers by May 2006. By June 2008, 2.47 million Pregnant Woman Vouchers and 369,000 infant vouchers had been redeemed (Hanson et al., 2009: 3). It is important to note, however, that in one study from 2007, just 60% of pregnant women who attended ANC reported receiving a voucher (Hanson et al., 2009). In another study in 2008, just 33% of currently pregnant women interviewed reported receiving a Pregnant Woman Voucher on their first visit, with a further 9% and 2% saying they got it in their second and third visit (Marchant et al., 2008). These figures suggest that targeting has been far from universal or consistent among pregnant women and suggest that other factors beyond being pregnant may have determined voucher receipt. The reasons remain somewhat unclear, though one explanation is that some staff appear to have asked women to show they had money to pay the top-up (Nathan et al., 2007, Nathan et al., 2008).

In addition, of those who received vouchers, a growing number did not go on to redeem them. Table 19 shows the number of vouchers distributed and redeemed between July 2005 and March 2009 along with associated redemption rates. The main reason given for non-redemption in the national household surveys implemented to monitor the TNVS was that the voucher recipient had no money to pay the top-up (Hanson et al., 2006, Marchant et al., 2007, Marchant et al., 2008). Given the growing wedge between receipt of a voucher and purchase of a subsidised net, net ownership rather than voucher receipt is used in the empirical analysis as the key variable of interest.

Table 19: Distribution and redemption rate of TNVS vouchers (July 2005 to March 2009)

Period	Pregnant women vouchers			Infant vouchers		
	Distributed	Redeemed	Rate	Distributed	Redeemed	Rate
July 2005 to March 2006	339,750	275,473	81%			
April 2006 to March 2007	1,203,900	996,436	83%			
April 2007 to March 2008	1,358,075	972,921	72%	472,025	309,166	65%
April 2008 to March 2009	916,334	547,860	60%	525,525	295,807	56%

Source: NATNETS data sheets. Note: Infant vouchers were available from November 2006, though it took some time for stubs and vouchers to be returned (by clinics and retailers respectively) and then counted.

Tracking studies from 2006/07 and 2007/08 found that around 10% of the distributed vouchers sampled were also likely acquired by ineligible recipients (Nathan et al., 2007, Nathan et al., 2008). However, it is difficult to determine the extent to which the capture of these vouchers and associated subsidised nets was channelled back into the commercial market. Analysis of ITNs reported as commercially purchased in the 2008 NATNETS Household Survey show that around 5% were below the lowest retail price reported in TNVS retail surveys, which could indicate the presence of secondary markets for nets resold below the market rate. If these were subsidised nets being re-sold then their impact on incremental ownership is difficult to determine as they could still have represented new sales that would not have gone ahead otherwise.

Alongside the TNVS, in August and December 2005 around 255,000 free nets were distributed in the Lindi and Mtwara regions among children under five years, linked with a measles vaccination campaign, in the Lindi and Mtwara regions respectively. At the same time free nets were also distributed in Rufiji district and smaller scale free net campaigns have been in place in various locations through different projects.

Together with other interventions as part of the National Malaria Control Programme, the TNVS helped contribute to a dramatic increase in households owning at least one mosquito net from 23% in 2004-2005 to 63% by 2010 and a reduction in the prevalence of parasitaemia in children under five years old within the Ifakara surveillance area from 25% in 2004-2005 to less than 5% in 2010 (Roll Back Malaria Partnership, 2012). However, as Figure 19 shows, after a general upward trend of increasing unsubsidised net sales, the start of the TNVS marked a period of declining commercial sales of unsubsidised nets, despite overall sales and coverage continuing to increase, raising the question of why the earlier growth in unsubsidised sales came to an end and then declined.

In terms of overall net coverage, data from the TNVS household surveys show a clear increase in the proportion of households owning at least one net between 2005 and 2008 (Figure 19). This included an increase in the proportion owning a net that had been treated within the past 12 months. Given the scale of the TNVS, it is likely to have contributed significantly to this increasing coverage. However, it is not possible to attribute the increases solely to the TNVS. For example, the free net campaigns will also have contributed and there may also be other underlying trends or temporal fluctuations that explain the changes in coverage.

While there may be a tendency to assume that each net purchased with a TNVS voucher represented an incremental increase in the number of nets owned, as suggested by the trends in unsubsidised sales in Figure 19, there are reasons to assume that this may not be the case due to possible crowding-out effects.

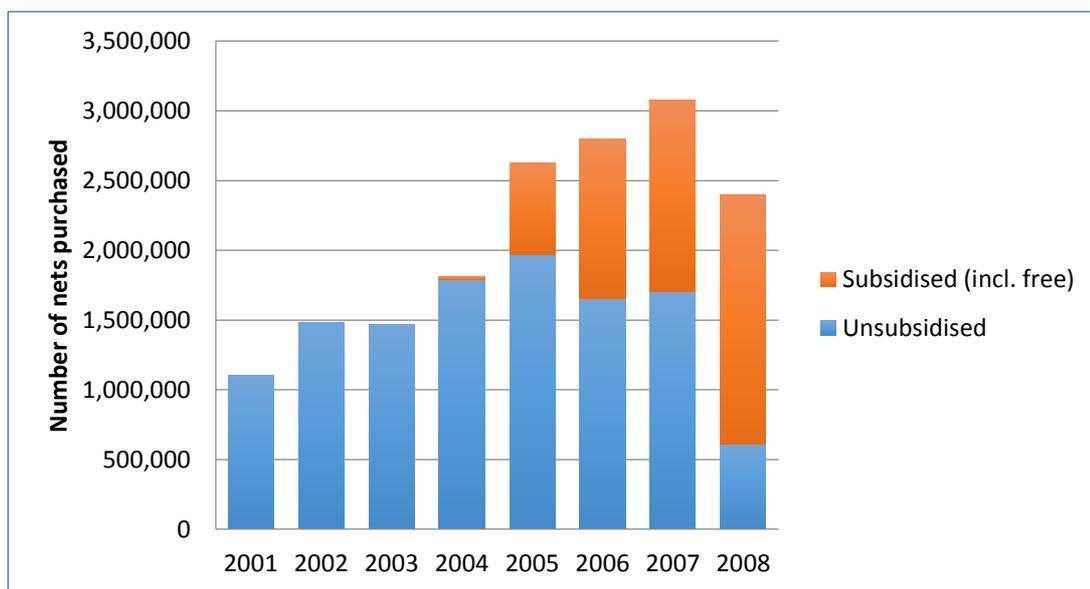


Figure 19: Sales of unsubsidised and subsidised mosquito nets in Tanzania (2001-2008)
Source: NATNETS data sheets.

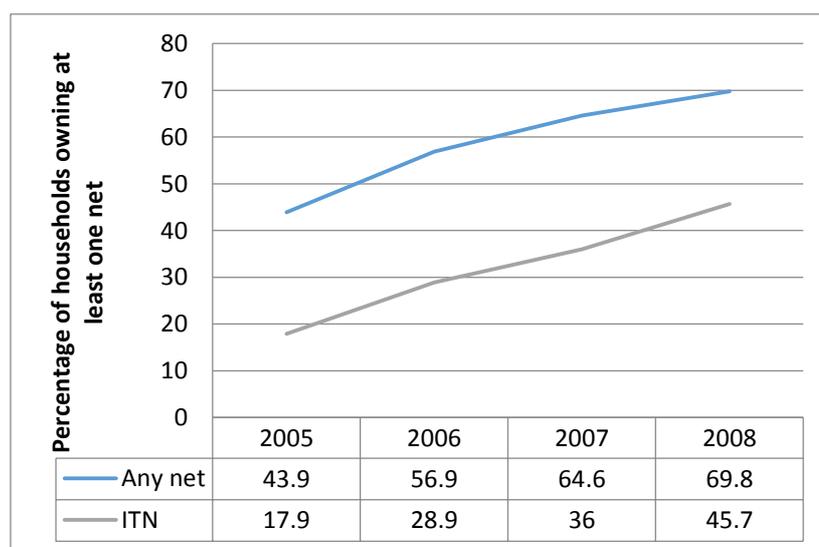


Figure 20: Trends in ownership of mosquito nets in Tanzania (2005-2008)
Source: (Marchant et al., 2008).

6.4.3 The TNVS after 2008

While this study focuses on the period from the start of the TNVS until 2008, it is important to note that a number of key policy changes have taken place since. This includes the introduction of a voucher for LLINs instead of conventional ITNs bundled with insecticide treatment. This was introduced in October 2009, with the top-up required moving to a fixed TZS 500 as part of a drive to address inequality in access to and use of nets. At the same time, one manufacturer – *A to Z Textile Mills* – was given the right to be the sole manufacturer of all LLINs distributed through the TNVS and mass free net campaigns, effectively removing the earlier private sector competition that had existed (Donaldson and Thiede, 2011). As a result, by 2012 it meant that LLINs were effectively no longer commercially available for anyone except through a TNVS voucher.⁴⁶ The configuration effectively completely displaced unsubsidised sales and also meant that, for a time, the voucher was redeemable for just a single type and size of net, removing the consumer choice that is supposed to be one of the key advantages of a voucher system.⁴⁷ From 2012 a second brand of LLIN was allowed to operate (NetProtect), which expanded the range of size, shapes and colours of nets including to those without a subsidy voucher. However, this re-opening of the market did not reach its potential and unsubsidised sales remained very limited.

A further change after the period of study was the introduction of e-vouchers, piloted in early 2011 and rolled out from 2012 with 60% of clinics providing them as of July 2014.⁴⁸ Other interventions since 2008 include a mass distribution campaign between 2008 and 2010 delivering nine million LLINs free of charge to children under five years old, followed in 2010 and 2011 by a Universal Coverage Campaign to cover all sleeping spaces not yet protected (Renggli et al., 2013). By the middle of 2012 it was then decided that the best approach would be to continue with the TNVS but to also introduce a programme distributing nets for free through schools (NATNETS, 2012). Most recently, the TNVS has been suspended following evidence of systematic fraud in the e-voucher system.

⁴⁶ Interview with senior official in NATNETS.

⁴⁷ Interview with senior official in NATNETS.

⁴⁸ Personal communication with official from NATNETS, November 2014.

6.5 Methods

6.5.1 Conceptual framework

Adapting the approach by Xu et al. (2009), one can think of the impact that a subsidy programme has on total ownership of the product being subsidised (*total*) as a partial derivative, where the incremental increase from a subsidy ($\frac{\partial total}{\partial subsidised}$) depends on both the increase in ownership arising directly from the subsidy itself ($\frac{\partial subsidised}{\partial subsidised}$) and any increase or decrease arising from changes in unsubsidised purchases (*unsubsidised*) caused by the subsidy programme ($\frac{\partial unsubsidised}{\partial subsidised}$) as a result of crowding-in or crowding-out respectively. This is shown in Equation 4 based on the identity in Equation 3.

$$total = subsidised + unsubsidised$$

Equation 3: Identity for total ownership in presence of a subsidy

$$\frac{\partial total}{\partial subsidised} = \frac{\partial subsidised}{\partial subsidised} + \frac{\partial unsubsidised}{\partial subsidised}$$

Equation 4: Impact of a subsidy on total ownership

If all of the subsidised products paid for by the government end up being sold as subsidised products then $\left(\frac{\partial subsidised}{\partial subsidised}\right)$ from Equation 4 becomes one, meaning that the effect of the subsidy programme on incremental ownership can be estimated simply by calculating $\left(\frac{\partial unsubsidised}{\partial subsidised}\right)$. However, if there is leakage of the subsidised products at any point in the distribution chain then $\left(\frac{\partial subsidised}{\partial subsidised}\right)$ is no longer one and $\left(\frac{\partial unsubsidised}{\partial subsidised}\right)$ will give a biased estimate of the impact of a subsidy on incremental ownership. If a portion of the subsidised products end up being diverted and resold as unsubsidised products then this will mean that *subsidised* from Equation 4 must be decomposed into leaked and non-leaked products. Similarly, *unsubsidised* must be considered as all unsubsidised products minus those which were actually leaked subsidised products (Equation 5 and Equation 6).

subsidised = nonleaked + leaked

Equation 5: Adjusted identity for subsidised products in presence of leakage

unsubsidised = (all unsubsidised – leaked)

Equation 6: Adjusted identity for unsubsidised products in presence of leakage

This leakage may occur in different ways depending on the design of the programme. For example, in the case of some fertiliser subsidy programmes in sub-Saharan Africa where the government takes on the responsibility of purchasing from importers then distributes and sells fertiliser at subsidised rates to those with a voucher, fertiliser may be diverted at one of a number of stages right through to the point of sale. Based on evidence of diversion in a Zambian fertiliser subsidy programme, Mason and Jayne (2013) accordingly adjust Equation 4 to take this into account, using estimates of the proportion of fertiliser that was diverted into the commercial system.

However, in the case of the TNVS where the government left it to the private sector to purchase and sell mosquito nets at a subsidised rate to those with a voucher, the scope for diversion is considerably reduced. Nevertheless, it may still occur from the point at which redeemed vouchers are returned first by retailers back up through the distribution chain for compensation (Figure 17). Here, leakage may occur both through re-sale by those who redeemed a voucher for a subsidised net or through voucher fraud.

There is some evidence to suggest local level leakage has taken place in the TNVS. For example, tracking studies from 2006/07 and 2007/08 found that around 10% of the distributed vouchers sampled were likely acquired by ineligible recipients who could not be tracked (Nathan et al., 2007, Nathan et al., 2008). However, it is difficult to determine the extent to which these vouchers and subsidised nets were re-sold commercially. Secondly, it is also possible that eligible recipients may have resold their nets at commercial or near commercial prices, leading to this not showing up on household survey data. There is some evidence for the presence of secondary markets in that around 5% of all nets reported as commercially purchased in the 2008 NATNETS Household Survey were bought at below the very lowest retail price reported in TNVS retail surveys, though this could also be due to reporting errors. More recently, further evidence has

emerged of vouchers being stolen and fraud taking place since 2008 (MEDA, 2010, NMCP, 2014). Despite the evidence, however, it is not possible calculate a reliable estimate of what proportion of subsidised nets were re-sold.

A final point to bear in mind is that, as indicated earlier, a subsidised product may crowd-in (or crowd-out) unsubsidised sales through social learning effects if non-beneficiaries come to view the use of the subsidised products favourably (unfavourably) and then go on to buy (avoid buying) an unsubsidised product themselves. This is not captured in the demand model framework described below due to a lack of the available data required.

The study estimates the effect that the TNVS had on demand for unsubsidised ITNs by modelling a household demand equation for unsubsidised ITN sales. A theoretical model of the factors determining demand is presented in Equation 7, drawing on a number of studies focused on sub-Saharan Africa (Carneiro et al., 2012, Chase et al., 2009, Dupas, 2010, Gingrich et al., 2011b, Hanson et al., 2005, Poulos et al., 2006, Rashed et al., 1999, Wiseman et al., 2007).

$$Y = f(P, M, I, C, S, H, He, A)$$

Equation 7: Theoretical demand equation for mosquito nets

In Equation 7, Y represents household demand for mosquito nets, which can be seen as a function of the following factors:

P = Market price of unsubsidised mosquito nets

M = Market factors affecting cost and availability (e.g. distance and market concentration)

I = Household income

C = Credit availability

S = Presence of any subsidies

H = Household socio-economic and demographic characteristics

He = Factors affecting potential health status of the household

A = Use of alternative methods of malaria prevention

The estimable Equation 8 was then constructed using what data were available.

$$Y_i = \alpha + \beta S_i + \gamma X_i + e_i$$

Equation 8: Basic empirical model to estimate crowding-in / crowding-out

In Equation 8, Y_i is the number of unsubsidised nets purchased by household i in the past 12 months prior to interview. S_i – the key variable of interest – is the number of TNVS subsidised nets purchased by the household 13 months ago or longer. X_i is a vector of covariates, which are presented in Table 20, e_i represents the residual error term and α , β , and γ are parameters to be estimated.

The time difference between the dependent variable and the main explanatory variable was chosen in order to permit a causal interpretation to be made between the receipt of subsidised nets and the future purchase of unsubsidised nets. However, given that ITNs are a durable good that are sometimes only purchased every few years, it should be noted that if any negative relationship were found between S_i and the dependent variable it may likely represent a displacement effect rather than a crowding-out effect operating through changes to individual preferences. Referring back to the earlier discussion on displacement, it is also the case that in the TNVS the private sector was used to sell subsidised ITNs and so, once again, the term displacement may be a more appropriate term for any negative relationship found. Even if any reduction in commercial sales affected private retailers that were not part of the subsidy distribution network, it is not clear this would represent crowding-out of the private sector overall. In any case, this level of analysis was not possible to conduct given the available data.

Estimation of Equation 8 effectively allows for the calculation of a counterfactual of what unsubsidised net purchases would have been for subsidy recipients in the absence of the subsidy, based on the unsubsidised ITN purchase decisions of similar non-beneficiary households, controlling for observable characteristics.

Table 20: Summary of variables used in estimation

Variables	Mean	Standard error	Description
unsub_purch_12m	0.22	[0.01]	Dependent variable. Number of unsubsidised nets bought in 12 months prior to interview
tnvs_13m_plus (referred to as S _i)	0.13	[0.00]	Number of nets bought with a TNVS subsidy voucher 13 months ago or more
tnvs_purch_12m	0.08	[0.00]	Number of nets bought with a TNVS subsidy voucher in 12 months prior to interview
free_net_12m	0.03	[0.00]	Number of free nets reportedly received 12, 13-24, 25-36 and more than 36 months prior to interview
free_net_24m	0.02	[0.00]	
free_net_36m	0.01	[0.00]	
free_net_48m	0.04	[0.00]	
distmed_4x7	3175	[3.74]	Weighted district median market price of a 4x6x7 mosquito net based on prices reported in household survey (TZS)
totalnets12m	0.69	[0.01]	Total number of nets in the household 12 months prior to interview (excluding unsubsidised nets purchased at 12 months)
quintile5	0.20	[0.01]	Wealth quintile of household (5= wealthiest). Quintile 1 is comparison group
quintile4	0.20	[0.01]	
quintile3	0.20	[0.01]	
quintile2	0.19	[0.01]	
rural	0.64	[0.01]	Household is rural or semi-urban. Urban households are comparison group
semiurban	0.27	[0.01]	
hheduc17	0.65	[0.01]	Head has 1 to 7 years of education or 8 or more. No education is comparison group
hheduc8plus	0.11	[0.00]	
heardPWV	0.75	[0.01]	Respondent had heard of the TNVS pregnant women vouchers
femalehead	0.23	[0.01]	Head is female.
headage2229	0.13	[0.00]	Head is 22 to 29 years old, 30 to 49 years old or 50 years or older. Under 22 is the comparison group
headage3049	0.47	[0.01]	
headage50plus	0.35	[0.01]	
profservbus	0.13	[0.00]	Household head is employed in professional/clerical role, service or business
hh_size	4.99	[0.03]	Number of people in the household
under5	1.12	[0.01]	Number of children in the household aged 5 years or younger
over50	0.55	[0.01]	Number of people in the household aged 50 or over
women1549	1.08	[0.01]	Number of women in the household aged 15 to 49
currpreg	0.11	[0.00]	Number of currently pregnant women in the household.
prevpreg12m	0.89	[0.01]	Number of pregnancies in the household in past 12 months
retaildensity	1.49	[0.01]	Participating retailer to population ratio x 10000 based on retailer data from MEDA and population projections from 2002 census
mprev	17.34	[0.17]	Percentage of children (6-59 months) testing positive for malaria in the region in the Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08

Source: Author's calculations.

6.5.2 Potential endogeneity arising from unobservable factors associated with subsidy receipt

Although there were clear guidelines and procedures to target vouchers to pregnant women and women with infants attending a measles vaccination, it is possible that the receipt and eventual use of vouchers may have been correlated with characteristics that are not observed (e.g. mothers who are intrinsically more interested in the health of their children). This means that S_i may be correlated with the error term leading to endogeneity and biased estimates. As such, an instrumental variable (IV) approach was taken using the *ivreg2* command in Stata to investigate potential endogeneity.

As is well known, IVs must satisfy two main requirements. First, the instrument must be correlated with the potentially endogenous explanatory variable (conditional on other exogenous variables). Second, the instrument must not be correlated with the error term in the main equation of interest (again, conditional on the other exogenous variables).

Two instruments (z in Equation 9) were identified which, while correlated with the potentially endogenous variable S_i , were not expected to lead to changes in the dependent variable independently, meaning that in Equation 9, $\beta_1 \neq 0$ and $\text{Cov}(z, e_i) = 0$, where e_i are the residuals from Equation 8.

$$S_i = \alpha + \beta_0 X_i + \beta_1 z_i + v_i$$

Equation 9: Reduced form equation for purchase of TNVS subsidised mosquito nets

The two variables that lent themselves to being an IV were the receipt of a subsidy voucher (*gotvouch*) and whether the household had heard of the infant voucher scheme (*heardIV*). The receipt of a subsidy voucher is clearly expected to be strongly correlated with the potentially endogenous variable S_i , despite the fact that not all vouchers were redeemed for subsidised nets as discussed above, as purchase of a subsidised net required ownership of a subsidy voucher. Similarly, it might reasonably be expected that awareness of the infant voucher programme would also be associated with S_i , as those that had purchased a subsidised net would have already been exposed to the subsidy programme. However, the strength of the correlation might be expected to be smaller with this instrument. Indeed, when each variable was regressed in turn on S_i , controlling for other exogenous variables, they were both strongly significant and *gotvouch* in particular shows a strong correlation (columns 1 and 2 in Table 21).

As highlighted, for the instruments to be valid, they should also not have any direct independent effect on the dependent variable (*unsub_purch_12m*) other than through the potentially endogenous S_i . Theoretically, this assumption appears relatively sound for the case of *gotvouch* as, aside from through being able to purchase subsidised nets, which may displace (and therefore be correlated with) future unsubsidised purchases, the receipt of a voucher should not generally affect future unsubsidised net purchases. One way in which it *may* do independently is if the receipt of vouchers were to have some form of social learning effect on individuals regarding the importance of owning mosquito nets, thereby encouraging the purchase of commercial nets regardless beyond the subsidy programme itself. However, it is unclear how important this would be in Tanzania given that it is a country with a relatively long history of mosquito nets, as discussed above. The instrument *heardIV* is also relatively unlikely to affect the purchase of unsubsidised nets other than through the purchase of subsidised nets, for the same reason given above. Indeed, when both instruments were included as explanatory variables in a model explaining unsubsidised net purchases with other exogenous covariates included, both were highly statistically insignificant (columns 3 and 4).

Table 21: Relationship between potentially endogenous explanatory variable S_i and instruments and between instruments and dependent variable

	OLS estimate in model explaining potentially endogenous explanatory variable		OLS estimate in model explaining dependent variable	
Variable	(1)	(2)	(3)	(4)
<i>heardIV</i>	0.08 [0.01] P<0.01		0.003 [0.02] P=0.91	
<i>gotvouch</i>		0.36 [0.02] P<0.01		0.002 [0.02] P=0.89
R ²	0.09	0.20	0.13	0.13

Source: Author's calculation. N=6918. Robust standard errors in square brackets.

The validity of both instruments was further tested by carrying out an overidentification test using the Hansen J statistic, which did not reject the joint null hypothesis that both instruments are valid ($p=0.73$). Both instruments were therefore used in an instrumental variables regression using the Limited Information Maximum Likelihood (LIML) estimator. Kleibergen-Paap *rk* Wald F Statistics were well above the ‘rule of thumb’ of 10, rejecting the possibility of them being weak instruments, though the F-statistic for *gotvouch* (428) was substantially higher than that of *heardIV* (30) (Appendix 16 and Appendix 17). Along with the weaker correlation with S_i identified above, this suggests that *gotvouch* may be a better instrument.

As *ivreg2* uses the same covariates from the second stage in the first stage auxiliary regression, an alternative control function approach was also adopted as a robustness check (Cameron and Trivedi, 2010). This involved first estimating a reduced-form model explaining the potentially endogenous S_i using relevant exogenous variables and the two instruments above. The estimated residuals were then saved. Second, the main equation based on Equation 8 was then estimated with the estimated residuals included as a covariate. The coefficient on the saved residuals allows for a Robust Wald test of the null hypothesis of exogeneity.

6.5.3 Data

The main data used to estimate Equation 8 come from the 2008 NATNETS Household Survey, implemented as part of the independent monitoring and evaluation effort for the TNVS. The full sample of 6,918 households was selected using a two-stage cluster random sample. At the first stage, 24 districts were randomly sampled, stratified by zone (see Appendix 14) and at the second stage 10 wards (clusters) of 30 households in each of the districts were selected based on probability proportionate to size. Within each ward, one sub-village was selected using simple random sampling, within which households were selected randomly. Sample summary statistics are presented in Table 22. Other data sources used include retailer data from MEDA and the 2002 census data. Malaria prevalence was obtained from the Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08.

In the absence of income data, income was proxied by using a wealth index. Asset quintiles were constructed using Multiple Correspondence Analysis (MCA), which is analogous to Principal Components Analysis but appropriate for discrete data (Howe et

al., 2008).⁴⁹ The index was constructed using information on housing conditions and asset ownership including livestock, with households then split into five quintiles based on their score (Appendix 15).

Table 22: Summary of 2008 NATNETS Household survey sample

Districts covered	24
Total sampled households	7,200
Number of refusals	46
Total sample after cleaning	6,918
Hhs by location	
<i>Rural</i>	4,416 (64%)
<i>Semi-urban</i>	1,855 (27%)
<i>Urban</i>	647 (9%)
Number of people per household	
1-2	979 (14%)
3-4	2288 (33%)
5-6	2666 (38%)
>7	985 (14%)
Average household size	
<i>Mean</i>	5
<i>Median</i>	5
<i>Standard deviation</i>	2.5
Gender of household head	
<i>Male</i>	5,294 (77%)
<i>Female</i>	1,624 (23%)
Years of formal education of head	
<i>None</i>	1,671 (24%)
1 to 7	4,498 (65%)
8 or more years	749 (11%)
Women aged 15-49	7485
Children <5 years old	7728
No. of women pregnant at time of survey	731
Number of live births in 12 months prior to interview	6129

Source: 2008 NATNETS Household Survey. Statistics are un-weighted.

⁴⁹ Experimentation with quintiles using PCA suggests that there is no difference in this particular case.

6.5.4 Choice of estimator

A cross tabulation of the dependent variable and the key explanatory variable is presented in Table 23, showing the number and frequency of unsubsidised purchases according to whether or not households also bought any subsidised nets 13 months ago or longer. It is clear that the large majority of households (85%) did not report purchasing any unsubsidised net within the previous 12 months, indicating that we are dealing with a corner solution outcome, where the dependent variable ‘takes on the value zero with positive probability but is a continuous random variable over strictly positive values’ (Wooldridge, 2002: 518).⁵⁰

There is considerable debate in the literature over which estimation methods are most appropriate for such models, depending on why the zeros are there (Angrist and Pischke, 2009, Breen, 1996, Jones, 2000, Maddala, 1983, Madden, 2006). Two potential candidates appropriate for the present case are the Poisson and Negative Binomial (NB) models, which are specifically intended to fit the distributions of count data and have been used before in estimating demand for mosquito nets (Poulos et al., 2006). These are estimated along with a double hurdle (DH) model, which has been used in the agricultural literature (Ricker-Gilbert et al., 2011, Xu et al., 2009), and has the advantage of accounting for the possibility that the decision to purchase any nets and the decision of how many to purchase may be determined by different processes. The DH approach involves first estimating a Probit model for the purchase of any unsubsidised net in the past 12 months, then a truncated normal regression for the determinants of the number of such nets purchased, conditional on any purchase. To implement this the study used the user-written Stata command *craggit*.

Average Marginal Effects (AMEs) were estimated as opposed to Marginal Effects at the Average as they are averages of actual marginal effects and so better represent the actual population (Wooldridge, 2002). OLS estimates are also presented for the purposes of comparison. All models used cluster robust standard errors.

⁵⁰ More accurately, the variable takes on a limited number of non-negative integers.

Table 23: Cross tabulation of frequency of unsubsidised nets bought in last 12 months and subsidised nets bought 13 months ago or longer

Number of unsubsidised nets bought (last 12 months)	Number of subsidised nets bought (over 12 months ago)				Total
	0	1	2	3	
0	5,092	673	82	4	5,851
1	679	51	8	0	738
2	206	7	0	0	213
3	65	0	0	0	65
4	29	2	0	0	31
5	8	1	0	0	9
6	7	0	0	0	7
7	2	0	0	0	2
9	1	0	0	0	1
10	1	0	0	0	1
Total	6,090	734	90	4	6,918

Source: 2008 NATNETS Household survey.

6.6 Results

Tests for endogeneity using the *ivreg2* command and Sargan-Hansen statistics do not reject the null hypothesis that S_i is exogenous ($p=0.96$ and $p=0.68$) (full results provided in Appendix 16 and Appendix 17). The estimated coefficients for S_i are also almost identical to those using OLS (-0.06 and -0.01), which is another indication that endogeneity may not be a problem in this particular case. Results from the second stage of the Control Function approach find the coefficient on the saved residuals (*lpuhat*) to be highly insignificant ($p=0.63$) and so the null hypothesis of S_i being exogenous is not rejected (full results available in Appendix 18). The remainder of the analysis therefore assumes that S_i is exogenous.

Poisson, NB and DH models were then estimated to assess the degree of displacement. Results from all models indicate a negative and highly significant overall effect ranging from -0.05 to -0.12 . AMEs across wealth categories indicate a considerably larger negative effect on future unsubsidised sales among the very wealthiest household category compared to poorer households, with the difference statistically significant at the 95% confidence level (Table 24). It is interesting to note that, even among the poorest

households, there was on average no evidence of crowding-in, demonstrated by the statistically significant negative coefficients for all quintiles.

Receipt of free nets over 12 months ago was not significantly associated with lower unsubsidised net purchases in any models. All of the other covariates are of the expected signs.

While results from the Poisson, NB and DH models provide similar results, details of the models and specification tests suggest that the NB may be most efficient. Firstly, as the Poisson model assumes equality of mean and variance (the equidispersion property), following Cameron and Trivedi (2010) a test for equidispersion was carried out. Results suggest significant overdispersion, indicating that the NB model is a better fit. This is supported by the NB model having a less negative log pseudolikelihood value and the fact that the dispersion parameter ($\ln\alpha$) is not zero. The NB model also had a much lower log pseudolikelihood value than the DH model. The full output for the NB model is presented in Figure 21. Full results of the DH model and Poisson model are provided in the appendices.

Table 24: Average marginal effects of past subsidised nets on purchases of unsubsidised nets in the last 12 months (using the full sample)

Average Marginal Effects of S _i	Overall AME	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Rural	Semi-urban	Urban
Negative Binomial	-0.11*** [0.03]	-0.06*** [0.02]	-0.06*** [0.02]	-0.07*** [0.02]	-0.09*** [0.02]	-0.29*** [0.07]	-0.07*** [0.02]	-0.14*** [0.03]	-0.34*** [0.09]
Pseudo loglikelihood	-3392								
Poisson	-0.10*** [0.03]	-0.05*** [0.02]	-0.05*** [0.02]	-0.06*** [0.02]	-0.07*** [0.03]	-0.24*** [0.06]	-0.06*** [0.02]	-0.13*** [0.04]	-0.27*** [0.08]
Pseudo loglikelihood	-3534								
Double hurdle	-0.12*** [0.02]	-0.09*** [0.02]	-0.08*** [0.01]	-0.09*** [0.02]	-0.11*** [0.02]	-0.24*** [0.05]	-0.09*** [0.02]	-0.15*** [0.03]	-0.26*** [0.06]
Pseudo loglikelihood	-3648.80								
OLS (with wealth interaction effects)	-0.05*** [0.02]	-0.001 [0.03]	-0.003 [0.02]	-0.03 [0.03]	-0.03 [0.04]	-0.15*** [0.05]	-0.02 [0.02]	-0.04 [0.03]	-0.12 [0.07]
R ²	0.13								

Source: Author's calculations. Cluster robust standard errors given in square brackets. Standard errors for the DH estimates were obtained using the *nlcom* command. Estimates calculated using *margins* command with the *over* () option for subsample estimates.

*** p < 0.01
 ** p < 0.05
 * p < 0.10

One can use the estimates from Table 24 to calculate the impact that the sale of partially subsidised nets had on incremental coverage of mosquito nets in Tanzania. For the purpose of illustration, if we take the overall NB AME of -0.11, this suggests that the 3,959,192 subsidised nets distributed through the TNVS between October 2004 and September 2008 may have actually increased coverage by just 3,523,681 nets (i.e. 89% of the total subsidised nets), after accounting for the effect of the subsidy on unsubsidised sales.

6.7 Discussion

6.7.1 Limitations

Before discussing the study's main findings it is important to highlight its limitations. Firstly, due to the availability of relevant data, the analysis only covers the period from the beginning of the TNVS up until 2008. This study therefore helps us to understand the impact of TNVS on incremental coverage in its early years.

Secondly, the estimates are based on household survey responses regarding net ownership, including recall over when nets were purchased and whether they were purchased using a subsidy voucher. Given this, there is some scope for recall error. However, there are no reasons to expect a systematic bias in a particular direction and it is likely that many households would remember whether the net was subsidised given that it required a recently pregnant woman in the households to have been given a voucher. Measurement error may also have occurred if voucher recipients bought a subsidised net and then sold it at a market or near market price. While they would be unlikely to report owning the subsidised net, any households surveyed that purchased one in this way would likely report it as unsubsidised. However, the impact any such resale and reporting would have on the estimates in the analysis would depend on whether the household that bought it had also previously purchased a subsidised net or not, making it impossible to accurately infer from the available data.

Finally, as noted in the conceptual framework, any potential increase (decrease) in unsubsidised purchases due to impacts on market prices remained outside the scope of this study and any social learning effects would not be captured with the approach used, as any such change in purchases would not be attributable to the subsidy programme. Investigating social learning effects would require further analysis, for example, looking at purchases among those in close geographical proximity to those who received a

subsidised net. There may also be a social learning effect that operated at a more aggregate level through the programme as a whole arising through messages disseminated that raised awareness of the importance of the public health concerns in question and the products being subsidised. In so far as these encouraged further purchases among non-beneficiaries, the models used in this study may underestimate the level of crowding-in taking place.

6.7.2 What the results say and some explanations

The results indicate that, although the TNVS increased overall coverage of ITNs up until 2008, it led to a less than one-for-one increase in net ownership. For every 100 subsidised nets the TNVS appears to have led to an incremental increase of between 88 and 90 new nets on average across all wealth groups. Incremental increases were considerably lower among the wealthiest households, where 100 subsidised nets contributed between just 71 and 76 new nets, providing support for the hypothesis that subsidies reaching those who would have already purchased unsubsidised nets are likely to lead to a displacement effect. Looking at the relationship between household wealth and demand for unsubsidised ITNs from the regression output in Figure 21, it can indeed be seen that there is a large positive and highly significant relationship between being in the highest wealth category (quintile 5) and having purchased an unsubsidised net in the 12 months prior to interview. The fact that a negative relationship between purchasing a subsidised net and future unsubsidised purchases was also found in each of the poorer wealth quintiles is discussed further below. The results are consistent regardless of the econometric model used, though OLS estimates are consistently lower.

In light of the distinction made in the literature review, it is likely that the effects observed are displacement effects rather than crowding-out effects for two reasons. Firstly, the TNVS used the private sector to sell subsidised nets. Secondly, as mentioned earlier, ITNs are a durable good that are not purchased with great frequency, and so the purchase of a subsidised net may have simply reduced the need for households to purchase unsubsidised nets in the year ahead. Further research would be welcome to investigate potential longer-term effects on individual preferences and the private sector as a whole.

There is some reason to believe that the estimates presented in Table 24 should be considered conservative given evidence of leakage and potential secondary markets for subsidised nets. While it is difficult to quantify the effect that leakage has had, if 5% of all subsidised nets were resold at market prices then (using the NB estimates) 100

subsidised nets would have led to 84 new nets rather than 89, or 80 if 10% of nets were re-sold. However, in so far as any positive social learning effects took place, as indicated above it would mean the estimates in this study underestimate the level of crowding-in effects, making it more difficult to judge the absolute impact of the TNVS on unsubsidised sales.

While not the main focus of the paper, the study does not find any evidence that the past receipt of free nets had any statistically significant effect on future unsubsidised purchases. This contrasts with some earlier studies that found a negative impact of fully subsidised nets on unsubsidised purchases (Chase et al., 2009, Gingrich et al., 2011a). One of the reasons the findings of the present study differ from the other studies may be the longer time period over which this study has estimated crowding-in /-out effects as the durable nature of bed nets means households may not be so likely to purchase many in a short period of time. The difference in findings between free and partially subsidised nets could be down to the fact that whereas free nets do not involve any expenditure, partially subsidised nets clearly do more to reduce a household's ability to purchase further unsubsidised nets in the near future.

The results fit the aggregate trend of declining sales of unsubsidised nets presented in Figure 19. Using a three-year moving average (to smooth short-term fluctuations) shows an average growth in unsubsidised sales of 18.5% in the three years leading up to the start of the TNVS (2002 to 2004) followed by a decline of 1% in the three years following it (2005 to 2007), though it is difficult to directly match up absolute levels of estimated displacement with actual declines due to the short-term volatility (particularly in 2008) and associated uncertainty over what sales would have been in the absence of the subsidy. It seems that while displacement may partially explain the trend of declining unsubsidised sales, there are other crucially important determinants of unsubsidised sales that should be investigated, not least the growth in commercial prices. The average nominal retail price of a standard 3x6 round net grew from TZS 3079 in 2005 to TZS 3300 in 2006/07 and TZS 4144 by 2007/08, with similar proportionate changes seen in reported wholesale prices (Mponda et al., 2008). Part of the reason for this may be general inflation and the global fuel crisis, which saw oil prices rising considerably from 2007 to mid-2008.

The results also fit with the study by Gingrich et al. (2011a) that investigated the effect of partially subsidised nets on unsubsidised sales, though that study suggested 'crowding-out' arose instead through increased demand raising the overall price of unsubsidised nets, causing lower purchases among non-beneficiaries. The present study identifies an

alternative (and potentially complementary) pathway to displacement or crowding-out: the subsidies reaching households that would have purchased unsubsidised nets anyway.

Increasing retail prices could well still be one reason behind declining unsubsidised sales though it would only explain the observed displacement in the present study in so far as higher commercial prices put off subsidy beneficiaries from buying further unsubsidised nets in the future (effectively limiting a crowding-in effect). However, high prices should have the same effect on those receiving and not receiving the subsidy, unless by virtue of having received the subsidy, beneficiaries in particular are more likely to hold off purchasing unsubsidised nets (e.g. if they expect to be able to get another subsidised net). More broadly, impacts of the TNVS on commercial prices require further investigation before a causal interpretation can be made linking the TNVS to higher wholesale prices.

The finding of displacement at first appears at odds with the findings by Dupas (2010) from a randomised experiment in Kenya. However, in that experiment ‘future net purchases’ were of subsidised nets and so it is not fair to suggest that study provides evidence of crowding-in outside a controlled experimental setting. That study does suggest, however, that in order for crowding-in to occur nets must be commercially affordable.

Overall, the findings do not appear to support the theory of subsidies crowding-in demand for unsubsidised nets and it is important to ask why no evidence for this was found. As noted earlier, there are two main mechanisms through which crowding-in has been thought to operate. First, through allowing people to experiment with products they would not have otherwise purchased, a subsidy may encourage them to make future unsubsidised purchases. Second, a predictable large-scale subsidy that translates into a consistent and substantial growth in aggregate demand for a product through the private sector (i.e. where the private sector is involved in selling the subsidised product) may allow retailers to expand their operations and potentially even bring down the market price of the product, e.g. through economies of scale.

In the case of Tanzania, awareness of the benefits of nets was already relatively strong as a result of the extensive social marketing activities that had taken place before the TNVS. The main constraint on the purchase of unsubsidised ITNs is likely to have been the high price of unsubsidised ITNs which, rather than going down, in fact increased over the period of study. While this study does not investigate the extent of growth in private sector activity, which may indeed have increased as a result of the TNVS, bringing down the market price of the product being subsidised is clearly crucial in order to achieve truly

sustainable coverage over the longer-term. It is also true that crowding-in may be difficult to observe for a product which is not purchased with great frequency, or in a situation where extensive subsidy initiatives continue to operate as individuals may choose to put off unsubsidised purchases if they feel they may be able to acquire subsidised products.

6.7.3 Policy implications

Given the considerably higher levels of displacement among the wealthiest households and the fact that subsidised purchases in that category did represent a significant share of overall TNVS sales,⁵¹ the most obvious policy implication is that in order to achieve a higher level of incremental sales with the same or fewer resources, programmes such as the TNVS could try to avoid subsidies reaching the very wealthiest households. However, one must be sure that there is evidence to show they are already purchasing the unsubsidised products. If not, a temporary subsidy may still be warranted. Indeed, despite 100 nets displacing between 24 and 29 unsubsidised nets among the wealthiest households, the TNVS still led to an overall incremental increase among these households. Means-based targeting is also likely to prove particularly difficult in many low- or middle-income countries and there is also a need to judge whether the additional costs of targeting would outweigh the costs of inefficiencies arising from subsidising products for households who are more likely to purchase them anyway.

The fact that displacement was still statistically significant on average among all categories of less wealthy households might suggest that even with more highly sophisticated targeting, some level of displacement could well be inevitable as wealth status will never perfectly correlate with purchase decisions. However, as suggested, it is likely that high commercial prices are a key factor undermining crowding-in and so it is imperative that any subsidy programme for public health products does not lose sight of the need for complementary actions to bring down commercial prices, which will help secure longer-term sustainability of coverage.

In terms of the debate raised by Dupas (2014) over whether it is better to provide products for free or to require partial payment, the finding of no longer-term crowding-out from fully subsidised nets (compared to the displacement from partially subsidised nets)

⁵¹ TNVS household surveys show a higher proportion of households in the wealthiest asset quintile received a pregnant woman voucher (PWV) voucher in 2008 than those in poorer quintiles ($p=0.01$) and a higher proportion of those redeemed PWVs ($p<0.01$). Redemption of PWVs was also higher in earlier years though not statistically significant. In 2008, coverage of infant vouchers was lower among the wealthiest households though redemption was higher than other quintiles ($p=0.10$).

suggests free nets may well be more effective in raising incremental coverage, providing the nets are indeed used appropriately. However, there is clearly a trade-off against the significant additional costs of distributing fully subsidised nets compared to nets where a portion of the cost may be recouped through the charging of a top-up fee. As such, a combination of the two may be preferable as has been the case in Tanzania.

6.8 Conclusion

Using a household demand model with nationally representative data, this study finds evidence that the purchase of partially subsidised nets was associated with fewer unsubsidised net purchases in the future. Future unsubsidised purchases were significantly lower among the wealthiest households, providing evidence of a targeting-based displacement effect. As such, it cannot be said that TNVS subsidised nets led to a one-for-one increase in overall incremental coverage. Care should therefore be taken in any future claims regarding the impact of subsidies on coverage. The study found no evidence of crowding-in, even among the very poorest, indicating that subsidies alone are likely to be insufficient for sustaining longer-term coverage of public health products and that more needs to be done to also bring down the commercial price of products. The findings constitute an important contribution to the debate over how to design subsidy programmes to improve and maintain overall coverage of important PHPs.

7 Discussion and conclusion

This final chapter takes a step back in order to look at the bigger picture and the broader implications of the findings of the thesis. Returning to the original aim and research objectives, the chapter first of all briefly reviews the rationale and approach of the thesis before summarising its key findings. The following section then considers the contribution of the findings, discussing their significance in terms of contributing to our knowledge around targeting and crowding-in and crowding-out, and to the improvement of future programme design. Finally, consideration is given to the general limitations of the thesis followed by some areas for future research.

7.1 Summary of rationale and approach of the thesis

Since the turn of the century there has been a surge in the number of AIS and PHPS programmes and policies across the globe, which has inspired a growing body of empirical research. However, despite the subsidies in both sectors sharing a number of similarities in their broad conceptual justifications, design features and challenges, research to date has been carried out within sectoral silos. While single sector research is essential for driving forward our knowledge and understanding of these initiatives, chapter 1 suggested various potential advantages to moving beyond the research boundaries of single sectors by considering the theory, methods and practice from two or more sectors together. This thesis therefore set out to investigate what theoretical, methodological, empirical or policy insights could be gained in relation to AISs and PHPSs by looking both within and across the agricultural and health literatures. A review of the theory, practice and challenges facing both types of subsidy revealed the interlinked topics of targeting and crowding-in / crowding-out to have gaps in the empirical literature, with scope for benefitting from the approaches and thinking of a different sector. That review led to the three empirical papers presented in chapters 4 to 6.

7.2 Empirical findings by research objective

As the main empirical findings have been discussed in chapters 4, 5 and 6, this section provides a brief summary of the overall findings with respect to the original research objectives from chapter 3. The first two objectives were concerned with targeting outcomes and their determinants in Malawi's FISP, covered in chapters 4 and 5. The third research objective, explored in chapter 6, concerned the question of crowding-in,

crowding-out and incremental coverage of ITNs in Tanzania's National Voucher Scheme. Research objective four is discussed in section 7.4.

Research objective 1: *To explore socioeconomic-related inequalities relating to coupon allocation, coupon redemption, and use of subsidised inputs in the Malawi FISP between 2006/07 and 2012/13.*⁵²

- a. **Still no overall pro-poor targeting of fertiliser coupons by 2012/13.** As of 2012/13, receipt of any fertiliser coupon was still on average disproportionately distributed among the less poor households despite a statistically significant reduction in inequality between 2006/07 and 2008/09. Households with greater asset wealth (particularly those around the middle of the distribution) also benefitted disproportionately in terms of the number of fertiliser coupons received, despite a statistically significant reduction in this inequality over time. Similar findings emerged when households were ranked by income measures.
- b. **Some limited evidence of wealthier households being more likely to redeem all fertiliser coupons in earlier years.** While the data do not reveal major differences between the wealth categories in terms of ability to redeem coupons for subsidised fertiliser, redemption of all fertiliser coupons was distributed slightly disproportionately among wealthier households in 2006/07 and 2008/09. By 2012/13 there was statistically no difference between wealth groups, suggesting that ability to redeem was not systematically determined by SES so much as other factors. However, the limited cases of reported non-redemption do make it difficult to draw firm conclusions. A less pronounced pro-wealth bias was found when using income measures.
- c. **Notable inequalities in access to subsidised fertiliser.** Consistent with the inequalities observed for the number of fertiliser coupons received, the findings showed fairly high levels of inequality over the years in terms of the volume of subsidised fertiliser acquired. The shapes of the CCs suggest households in the middle and upper-middle of the wealth distribution gaining particularly disproportionately. There was some statistically significant reduction in inequality over time though not enough to become overall pro-poor as of 2012/13.

⁵² The research in chapter 3 focused specifically on fertiliser, being by far the most valuable of all inputs distributed in the FISP.

d. Limited evidence of wealth-based differences relating to input use (among fertiliser obtained through coupons). Of the fertiliser obtained through subsidy coupons there was limited evidence of socioeconomic-related inequality in how that subsidised fertiliser was used, with the value for the CI only being statistically significant (and positive) in 2008/09, when the estimate showed poorer households were more likely to report some other use of inputs. There was no difference using income measures. However, in general it was difficult to identify any inequalities due to the very low number of households reporting to have used fertiliser other than on their own land.

Research objective 2: *To identify and assess the importance of different factors that determined the allocation and redemption of subsidy coupons in the FISP and use of subsidised inputs among smallholder households.*

a. Power and informational asymmetries are crucial in CBT and coupon redemption. One of the main findings that emerged from the interviews, and appeared important in beneficiary selection through to coupon redemption and use of subsidised inputs, was the role of power and informational asymmetries. In beneficiary selection and the allocation of coupons, the asymmetries between local leaders and the wider village population meant that leaders were able to exercise considerable control over the allocation of coupons with limited accountability. The current approach of the FISP's beneficiary selection and coupon allocation mechanisms being left to communities was found to end up by default granting overwhelming power to traditional authority systems and to permit village leaders to divert some benefits for themselves and those with whom they had good relations. Responses from many of the farmers revealed how leaders can also deprive villagers of their right to being fully informed of the official guidelines, strengthening the position of leaders to act according to their own will. In all areas visited, the approach also resulted in the ultimate use of subsidised inputs being partly dictated by local leaders who requested them to be shared with others. While this may represent an attempt to deal with the low coupon to eligible beneficiary ratios and an attempt at achieving a sense of fairness, it can also be used to effectively compensate for leakages taking place from the village head upwards. Finally, power asymmetries were also crucial in mediating the outcomes of fertiliser coupon use, with a privileged position being

granted to fertiliser depot staff who in some localities appear able to capture substantial rents alongside local vendors, both through the hiking of official top-up prices as well as diversion of subsidised inputs.

- b. The importance of village politics.** With regard to beneficiary identification and coupon allocation, the current system also effectively supports the playing out of local village politics in cases where the position of village leaders requires them to respond to demands from their villagers. Ultimately, however, depending on the local context, this can allow more empowered households that are better able to petition, leaving some of the more marginalised households without a voice and without access.
- c. The role of poverty.** Poverty was also identified to be a crucial factor mediating the choices households made or were forced to make regarding the use of coupons and of any subsidised inputs they received. One of the main drivers in this respect was the pressing need facing some poorer households for cash to meet various expenditures, such as food, medical costs and costs of education, leaving some households prone to selling coupons and / or a portion of their subsidised inputs. Various other challenges also arose relating to household poverty, including the additional obstacles that it creates at depots where prices are inflated through the involvement of unscrupulous depot staff and vendors. This is broadly consistent with the quantitative analysis from chapter 4 (during earlier years of the FISP), though the relatively small sample of respondents reporting non-redemption of coupons and alternative uses of subsidised inputs in household surveys makes it difficult to say how widespread the problem really is.

Research objective 3: *To estimate the impact that the TNVS had on commercial ITN sales and overall ITN coverage between 2005 and 2008.*

- a. Mild overall displacement of unsubsidised commercial sales.** Results from the household demand model in chapter 6 showed that the purchase of subsidised nets through the TNVS was associated negatively and highly significantly with the future purchase of unsubsidised commercial nets after controlling for a range of other explanatory factors. On average, every 100 subsidised nets purchased was associated with a reduction in the purchase of between 10 and 12 unsubsidised nets. This suggests that the TNVS had a slightly negative impact on the purchase

of unsubsidised equivalent nets by displacing unsubsidised sales that would have gone ahead in the subsidy's absence.

- b. Transmission of subsidies to the very wealthiest households had the strongest displacement effect.** The average level of displacement was significantly greater among households in the very wealthiest category that purchased a subsidised net, where every 100 subsidised nets was associated with a reduction of between 24 and 29 nets. This finding supports the hypothesis that one of the pathways for displacement is through substituting for sales that would have gone ahead anyway. However, displacement still appeared to take place among all wealth groups.
- c. Overall the TNVS made a positive contribution to incremental coverage of ITNs.** Despite evidence of displacement, overall the TNVS still made a positive contribution to the level of ITN coverage in Tanzania. Based on the estimates of displacement, the 3,959,192 subsidised nets distributed through the TNVS between October 2004 and September 2008 appear to have led to an approximate increase of between 3,484,089 and 3,563,273 (i.e. between 88% and 90% of the total subsidised nets). However, these estimates come with the caveat that the demand model did not capture impacts that the TNVS may have had in increasing unsubsidised purchases through localised and population-wide social learning effects. It also does not capture any effect that the subsidy programme may have had in altering the market price of nets.
- d. No evidence of fully subsidised nets crowding-out unsubsidised purchases.** Finally, the results from chapter 6 indicate that, in contrast to the partially subsidised nets from the TNVS, the past receipt of fully subsidised (free) nets did not have the same negative impact in displacing unsubsidised purchases.

7.3 Contribution to knowledge

The findings from this thesis make a number of contributions both to the programme specific empirical literatures on targeting outcomes and crowding-in and crowding-out, as well as to the broader theoretical frameworks applicable to both sectors. This section now considers contributions to the literatures on targeting, crowding-in and crowding-out, before concluding with a reflection on the contribution to our understanding of the utility of a cross-sector approach to research. The contributions are discussed in relation to existing literature.

7.3.1 Targeting and vouchers

As far as the author is aware, this was the first study to have used CCs and CIs to measure the targeting outcomes of an AISP. Their use in the agricultural literature in general also appears to be largely absent. The study has demonstrated the utility of using these methods not only as a means of gaining richer insights into the full distribution of targeting outcomes across a population over time and space, but also in terms of them being a useful visual tool for communicating programme outcomes to a policy and research audience. It is hoped that dissemination of chapter 4 will contribute to greater awareness of these methods within the agricultural literature in order that they may be used more widely.

The findings from chapter 4 also update our understanding of targeting outcomes in Malawi's FISP through the use of more recent data than has been used in previous studies. The application of CCs and CIs to three datasets has also demonstrated how outcomes have changed (or not) over time. The findings are in line with earlier studies cited in chapter 4, which found the receipt of coupons and volume of subsidised fertiliser to be associated with measures of wealth. They are also in line with the more recent study by Kilic et al. (2013), which used data covering the 2009/10 agricultural season and argued it was those in the middle of the distribution disproportionately benefitting. The present study demonstrates this finding more clearly using CCs and also explores a wider range of stages in the subsidy allocation process and demonstrates the continued failure over multiple years of the targeting mechanisms within the FISP to achieve their intended objectives.

The findings from the primary research carried out by the author and reported in chapter 5 offer the first known attempt at explicitly assessing the key factors driving targeting outcomes at the community level at the various stages of subsidy transmission to beneficiaries in the FISP. They add to and update the very limited body of empirical evidence looking at local targeting processes and obstacles facing improved targeting outcomes and help us to understand a number of key factors and informal processes which explain *why* the observed targeting outcomes are as they are. This is crucially important for policy makers with an interest in improving targeting outcomes. For example, interviews across the four separate locations highlighted that the bottlenecks at fertiliser depots that create opportunities for rent seeking may be a crucial factor undermining stock availability, which in turn underpins not only non-redemption (which was a number one

concern of two district level officials) but also appears to stimulate a secondary market for subsidy coupons.

A number of findings from the primary research are broadly in line with earlier evidence from programme evaluations, for example, the important role played by village leaders in determining subsidy coupon allocation (Dorward et al., 2013). However, the findings go into greater depth in explaining the underlying processes and village politics that can occur and determine outcomes. The findings confirm the hypothesis by Dorward et al. (2013) that the open forums, which have been promoted since 2008/09, are not truly 'open' in terms of allowing for genuine participation and accountability. The study also explained what the high reporting of 'redistribution' in the 2012/13 FISS actually means in the village context by revealing how village leaders in all four villages enforced sharing with other households.

Some findings did seem to contradict certain conclusions from previous studies. First, the use of semi-structured interviews in this thesis appears to have identified a greater lack of awareness of official FISP guidelines than a previous study by Mvula et al. (2011), which concluded that people were generally aware of official targeting criteria. Part of the reason for this may be that the conclusion by Mvula et al. appears to have depended particularly upon reports from FGDs and village leaders, which may have reflected the opinions of more empowered individuals and not provided such a voice to more marginalised individuals. This is an important point, as the lack of awareness found through the semi-structured interviews highlighted a further means through which local leaders can seek to dominate and control the distribution of subsidies.

The findings also contribute to the broader empirical literature on CBT, where it has been mentioned a number of times that evidence and documentation on the performance of CBT has been lacking (Coady et al., 2004, Ravallion, 2003, Ridde et al., 2010). This in turn feeds into the broader theoretical CBT literature. On the one hand, findings are broadly in line with a number of empirical studies that highlight the limitations of using CBT to transfer central government benefits. For example, a study by Scheffel (1999) also highlights the importance of power asymmetries in the case of a programme in Slovakia, where local councils representing the dominant Gadjo majority denied Roma access to government benefits. A study on Bangladesh's Food for Education programme also appears to highlight the importance of power asymmetries and the local political economy, finding that more unequal villages in terms of land ownership were worse at targeting poor households (Galasso and Ravallion, 2005). There are also parallels with a

study reported by Coady et al. (2004) of a rice subsidy in Indonesia in which village elders in some villages disagreed with the central policy goals of selecting beneficiaries and instead divided the village's quota of rice among all members.

On the other hand, the findings contrast with some evidence of CBT having performed relatively well in achieving targeting aims (Alderman, 2002, Coady et al., 2004). The reasons for these differences appear to lie in a number of factors, including programme design and local context. Concerning programme design, in their large-scale review of different targeting approaches, Coady et al. (2004) note that the studies they found on CBT may have performed unusually well as 'several of the programs that use community targeting use other methods as well that may be responsible for a good deal of their power'. They cite the example of Mexico's PROGRESA social transfer programme, which first of all used a poverty map to select poor areas, then a PMT to screen out non-poor residents, before using CBT as a final stage. As part of their overall findings, targeting performance also improved with country income levels and indicators of government accountability, suggesting that CBT may face greater challenges in low-income contexts such as Malawi.

Overall, the findings from this thesis lend support to the hypotheses put forward by a number of authors that the theoretical advantages of CBT (e.g. better information, greater accountability and building social capital) may in some cases be tempered or outweighed by rent-seeking, capture by local elites, reinforcement of existing power structures and use of criteria at odds with the programme's targeting criteria (Conning and Kevane, 2002, Mansuri and Rao, 2012, Ravallion, 2003). They also suggest that social capital may be actively undermined due to the targeting process raising social tensions.

The findings also contribute to our theoretical understanding of the conditions under which CBT may be less appropriate as a mechanism for targeting. These include: contexts in which local traditional leadership structures are culturally revered and offer a privileged position through which they may abuse their authority; where there is limited scope for government oversight or monitoring (e.g. stretched extension services); where the decisions concern distribution of resources that represent significant value and therefore raise the returns from elite capture, patronage and rent seeking; when the targeting criteria of the programme concerned are very broadly defined; and in contexts where it may in practice be difficult to distinguish between eligible households.

The findings from the empirical chapters on targeting in the FISP combine with those from Chapter 6 to highlight the broader challenges and limitations of targeting across

both agriculture and health sectors. On the one hand, findings from Chapter 6 show how categorical targeting has its limitations through not being able to distinguish between those that were more or less likely to have purchased an unsubsidised ITN. If targeting were based on socioeconomic status, it could have substantially reduced levels of displacement, allowing the government to use the financial savings to expand coverage among other households that were less likely to have purchased an unsubsidised net (though subsidised nets reaching even the wealthiest households did still have an overall positive effect on increasing incremental ownership of ITNs). On the other hand, the findings reveal how, even if the TNVS were targeted using some form of means-test (which would have likely involved greater financial costs), some level of displacement would have still been likely as small levels of displacement were found even among the poorest households, suggesting that factors other than wealth were influencing the choice of whether or not households purchased ITNs.

The findings also contribute to the wider literature on vouchers. Overall, the evidence on vouchers generally suggests voucher programmes have been successful at raising the consumption of key goods and services and have largely facilitated the effective targeting of specific groups of individuals (Ensor, 2003, Meyer et al., 2011). However, there has been far less investigation into the processes underlying voucher programmes. Where it exists, evidence has highlighted the scope for malpractices in the targeting and transmission of benefits from voucher subsidy programmes. For example, an in-depth programme evaluation of a voucher programme for maternal health services in Bangladesh found reports of nepotism in the distribution of vouchers where relatives were more likely to receive vouchers, as well as evidence of pressure on voucher distributors to provide vouchers to those who were ineligible (Hatt et al., 2010).

A further reason for the relatively limited amount of evidence on processes may be due to the sensitive nature of corruption and the fact that there are incentives that keep such discussions from being published. For example, since the analysis of the TNVS in this thesis, the programme has been closed due to an internal audit revealing evidence of systematic misuse of e-vouchers among health workers and local retailers. Specifically, health staff were found to be using fake health card numbers and colluding with retailers and ITN sales representatives to redeem vouchers without the exchange of a net to a beneficiary. Crucially, this was made possible through collusion between local actors and the absence of unique identifiers for the health cards against which vouchers were

assigned. This case reveals that the mere use of e-vouchers in itself is not a solution to overcoming problems relating to corruption.⁵³

The findings here therefore contribute to a relatively limited qualitative evidence base on the operation of vouchers but seem to be consistent with concerns raised elsewhere. From a theoretical perspective there are three key lessons. The first concerns the theoretical benefit of vouchers being a tool that allows for the effective targeting of intended beneficiaries. Clearly, whether or not this is the case hinges upon having in place an adequate beneficiary selection mechanism; the use of vouchers in and of themselves cannot be assumed to improve the targeting of goods or services.

The second lesson is that the theoretical argument that vouchers may help overcome some of the potential corruption associated with pure cash transfers due to the virtue of vouchers only being redeemable for certain goods and services and for certain individuals, ignores the fact that controls on who can redeem coupons for what are themselves operated by individuals, who may be corruptible. Also, the extent of scope for corruption may partly depend upon the good or service being subsidised. So whereas access to specific services may be less readily transferable, certain goods such as fertiliser in Malawi, for example, are easily tradable and in high demand and therefore relatively open to corruption. Though this does not mean that other forms of corruption may not also take place, however, such as requests for bribes and, as the TNVS case highlights, the use of ghost beneficiaries without even the need for any exchange of goods.

Thirdly, it must be emphasised strongly in the theory around vouchers that the pathway from voucher allocation to voucher redemption and access to the intended subsidised products or services is dependent upon a wide range of conditions, not just including availability of the products or services, but upon the absence of rent-seeking and corrupt practices, which in practice may be extremely difficult to monitor and combat in many low-income country settings.

7.3.2 Crowding-in, crowding-out and displacement

As the review of literature in chapter 6 explained, very few studies have looked at the effect of partially subsidised ITNs on the sale of unsubsidised ITNs, yet the investigation of such effects is essential for understanding the impacts that PHPS programmes have on *incremental* coverage of the PHPs being subsidised. It is also important for informing the

⁵³ Communication with senior NATNETS official.

theory around whether and when PHPs help pump-prime demand for unsubsidised equivalent products. The analysis in chapter 6 was the first attempt the author is aware of to use a household demand model approach to estimate the effect that purchasing partially subsidised ITNs has on the purchase of unsubsidised ITNs at the level of the household and wider economy.

The finding of partially subsidised ITNs displacing sales of unsubsidised ITNs is consistent with the findings in the one other study that has looked at the impact of partially subsidised nets on unsubsidised nets using a partial equilibrium framework (Gingrich et al., 2011a). However, this thesis contributes to the evidence and theory by suggesting a different pathway; one that operates as a result of subsidies reaching those who would have already purchased an unsubsidised net, rather than through the subsidy programme as a whole raising prices. This is further supported by the displacement estimates in this thesis being greatest among the wealthiest households. The price pathway may well also exist, though further research is required to prove any causal effect that the TNVS may have had on increasing prices given other key factors that may have explained the price increases in Tanzania at the time.

The fact that there was displacement in all wealth categories also means that there was, on average, no crowding-in. This is an interesting finding because it appears to run counter to the theory that subsidising PHPs may help pump-prime private sector markets through increasing future demand. However, it must be noted that this does not mean private sector markets have not expanded overall due to the increased aggregate demand from subsidised sales as the private sector was involved in selling subsidised nets (see conceptual framework below). It does raise the question though of why the purchase of partially subsidised ITNs did not on average stimulate further unsubsidised ITN sales.

One explanation could be that crowding-in effects are less likely to be observed while a subsidy programme is still in place if those who received a subsidised product hold off from purchasing further unsubsidised equivalents due to expectations that they may be able to acquire subsidised versions again (i.e. an 'expectation effect'). However, this effect should also apply to those who did not receive a subsidy (unless they know they will be ineligible), which should therefore also dampen demand for unsubsidised products among non-recipients, which would result in lower estimates of crowding-out. Instead, it may be that, given the durable nature of ITNs, it may require a longer time period over which to observe any potential crowding-in effects. Crowding-in would of course

necessitate though that market prices were low enough for people to be able to purchase unsubsidised equivalent products.

Another possibility could be a potential ‘anchoring effect’, where those receiving partially subsidised products come to value the products at the price they have paid, making them more reluctant to pay a higher price in the future. The one previous study known to have tested for such effects in the past found no evidence for it, though only when ITNs were free or of a very low price (Dupas, 2010). It may be, therefore, that there are anchoring effects at higher prices. Also, discussing her study, Dupas acknowledged that ‘as the subsidy was provided by a local research organization, households in the study might have been less likely to exhibit anchoring effects than they would have if the subsidy had been implemented nation-wide by the government’ (Dupas, 2010: 24).

It is also interesting to contrast the finding of displacement from partially subsidised ITNs with that of no displacement arising from free nets. The latter finding does conflict with two other studies that have looked at impacts of free nets on unsubsidised purchases (Chase et al., 2009, Gingrich et al., 2011a). However, the study by Chase et al. was only based on reported WTP rather than actual unsubsidised sales and the study by Gingrich et al. was based on data from one year, which does not therefore offer the insight into longer term effects that this thesis does.

Looking at studies which have looked at the impact of free nets on *subsidised* purchases, the findings in this thesis run counter to those by Gingrich et al. (2014), who found a substantial immediate reduction in the number of subsidised nets being sold during a mass free net campaign and Gingrich et al. (2011b) who found a short-term negative association between receipt of free nets and purchase of partially subsidised nets. However, the campaign covered by the former was unique in that it involved the distribution of a substantial 8.5 million nets while the latter study only considered short-term impacts, which did not allow for impacts on future purchases. The findings from this thesis are, however, consistent with findings by Eze et al. (2014) and Dupas (2010), both of which suggested no evidence of free ITNs undermining subsidised ITN purchases, and Dupas even finding some crowding-in effects. However, it must be remembered these studies look at impacts on subsidised nets.

How might the difference in displacement through partially subsidised nets and free nets be explained? One explanation could be that while receiving a free product may affect the marginal utility a household gains from further such products, it does not affect a household’s budget constraint in the way that a partially subsidised product would. Fully

subsidised products will therefore not have the same limiting effect on future subsidised purchases in terms of the household's budgetary resources. This is a crucially important distinction that does not appear to have been made in the literature so far.

In brief, the empirical findings on displacement make an important contribution to our knowledge of the extent to which targeting partially subsidised ITNs using categorical targeting (that does not take into account ability to pay) may displace unsubsidised sales and potential differential impacts of full versus partial subsidies. They also highlight a number of potential reasons why we do not observe crowding-in effects.

Drawing on these findings and the review of both the AIS and PHPS crowding-in/ -out literatures also allows for the development of a more all-encompassing theoretical framework through which to consider the various aspects and types of crowding-in and crowding-out that can arise from subsidy programmes. This is presented in two parts. Figure 22 concerns the demand side of voucher subsidy programmes, which relates particularly to the issues of targeting that this thesis has focused on. Figure 23 then illustrates how there can also be crowding-in/ -out on the supply side depending on the design and implementation of distribution and retail of subsidised products, and impacts on market prices. Note that the distinction between crowding-out and displacement is not made explicit in the diagrams, which assume government provision of subsidised products, though they may of course be adapted.

These figures represent a first attempt at what is intended to be a useful set of frameworks for researchers and policy makers in both sectors, highlighting some key points of consideration that underpin issues of raising the incremental benefit of a subsidy programme over the longer-term. A number of key features that are important to note, particularly those arising from the work in this thesis, are summarised below for each framework.

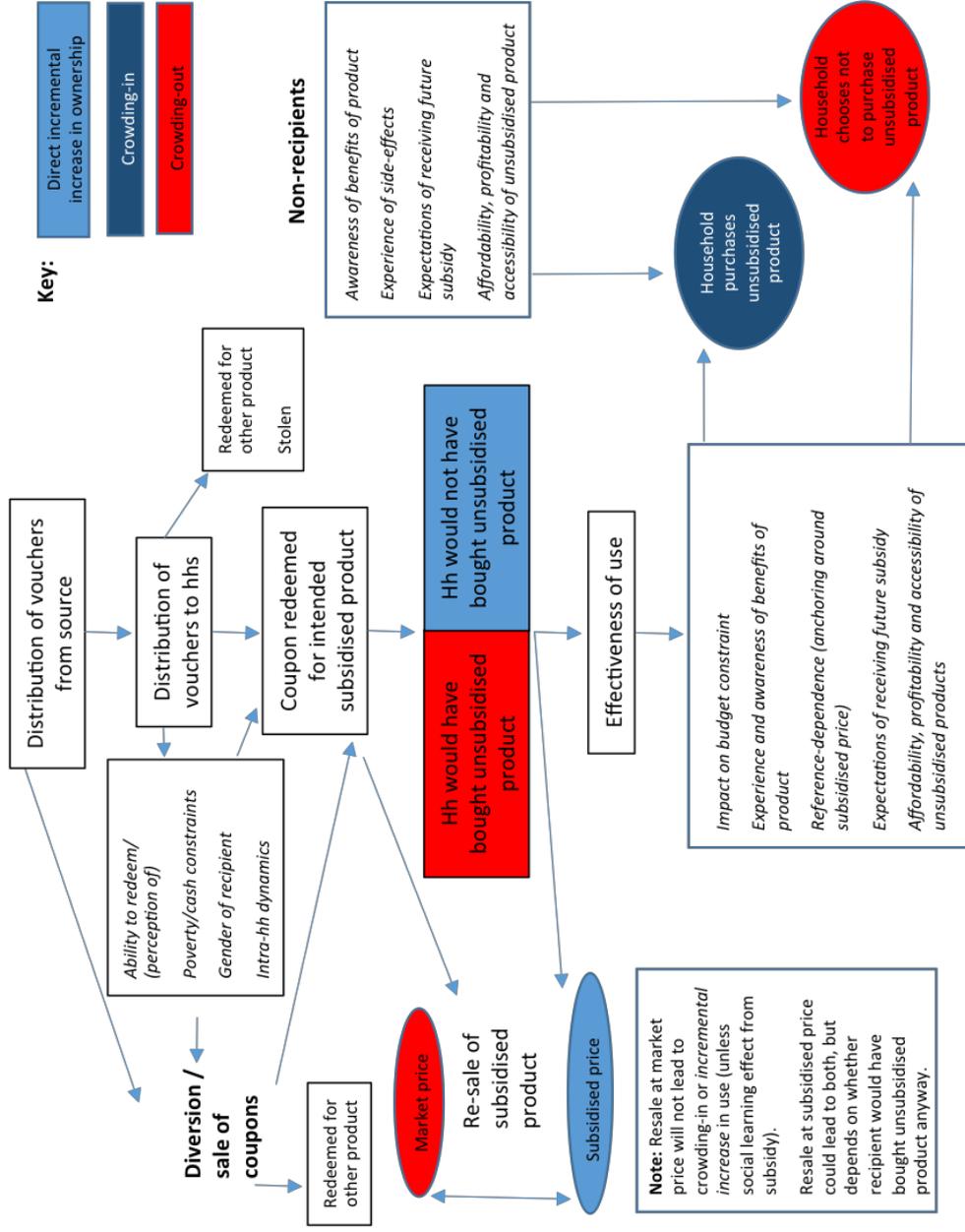


Figure 22: Impacts of subsidised products on the demand side
 Note: HH = household. Lists of items in italics are mediating factors.

Impacts of subsidised products on the demand-side

- Firstly, Figure 22 helps highlight how diversion of vouchers at various levels may have different impacts on crowding-in/ -out and incremental coverage or use of the product being subsidised depending on how vouchers are used. For example, if redeemed for products that are then sold at market or near market rates (centre left of diagram), it is likely to displace unsubsidised sales. Drawing on chapter 5, Figure 22 shows how after vouchers reach households, various mediating factors such as perceived ability to redeem the voucher and gender or cash constraints may mediate how they are used.
- Secondly, at the centre of the framework it can be seen how subsidised products reaching households that would have purchased unsubsidised products anyway reflects crowding-out (or displacement), while those reaching households that would not have represent a *short-term* increase in incremental coverage or use of the product arising directly from the programme. In chapter 6, it was shown that in the case of the TNVS, subsidies reaching the wealthiest households had a larger crowding-out (displacement) effect. There is an important distinction to make here however between the direct effect arising from the subsidy programme itself and *longer-term* crowding-in or crowding-out effects that arise after some delay or even beyond the life of the programme. It is the combination of both that gives the overall incremental impact on ownership. This distinction has important methodological implications for past and future attempts at measuring crowding-in/ -out using household demand models as, if insufficient time is allowed for crowding-in to be observed then findings may be biased towards finding crowding-out. This depends on factors such as the frequency of purchase of the specific product and also the continuation of the subsidy programme itself.
- Keeping the short-term versus long-term distinction in mind is also crucial for focussing attention on those conditions (including those in italics in the boxes) that must be in place in order for a subsidy programme to achieve one of its theoretical advantages of raising use of the product being subsidised beyond the life of the subsidy. It was suggested earlier that some of those factors in the centre bottom box in italics (e.g. affordability, expectation of receiving future subsidy and impact on the budget constraint) could have held back crowding-in from being observed in the TNVS. The impact on the budget constraint in particular may help account for the observation in chapter 6 that crowding-out was observed for partially subsidised nets yet not for free nets.

- Thirdly, drawing from the reference to social learning effects found in the PHPS literature (Dupas, 2010), another important point that Figure 22 raises is how a subsidy programme may still affect the purchase decisions of non-recipients, e.g. through social learning effects. This may be mediated by a range of factors in the box to the centre right of the diagram, such as their perceptions or experience of the benefits of the products. It is an area that has so far been somewhat overlooked in the agricultural literature but may have implications for measuring crowding-in and crowding-out using demand model approaches. Further research in this area would be helpful.
- A final important point to note, drawing on chapter 5 on Malawi's FISP, is that ownership and use can be quite separate things and that there is an important need for appropriate monitoring and evaluation to uncover how subsidised products are genuinely used.

Impacts of subsidised products on the supply side

- The main function of Figure 23 is to highlight how, in addition to crowding-in or crowding-out / displacement taking place through the targeting and use of vouchers, a subsidy programme may also have the effect of crowding-in or crowding-out the private sector more generally through its distribution arrangements. This may occur at a number of levels, from importers to manufacturers and retailers, depending on the specific design of the programme. For example, a programme would be particularly vulnerable to crowding-out where the government takes it upon itself to sell all subsidised products itself as this effectively removes the market from private sector actors. It is still possible that crowding-in could arise, though the conditions under which this would take place are considerably narrowed (e.g. providing subsidised products did not reach those who would otherwise purchase unsubsidised equivalents from private retailers). As shown in the case of the TNVS and FISP, this may often be a difficult condition to achieve. This highlights how the demand side and supply side frameworks come together. For example, if due to weak targeting there is crowding-out under a system where the government is fully responsible for selling the subsidised products, this will more likely have negative impacts on the private sector compared to a system where it is the private sector selling subsidised inputs. The reason being that in the latter case, even if unsubsidised sales are displaced,

the subsidised sales will still benefit the private sector (or at least those retailers who sell subsidised products).

- Figure 23 also highlights the point raised in chapter 5 regarding the danger of the public sector procuring the subsidised goods directly rather than allowing the private sector to do it on the government's behalf. As shown, this can create a liability for the government, with any diversion of products for subsequent sale within the country then potentially leading to crowding-out and limiting the impact of the subsidy programme on incremental coverage. If diversion is sufficiently large, the downward arrow shows how it may also lead to downward pressure on the market price of equivalent products, as suggested by Takeshima et al. (2012).
- As in Figure 22, the market price of unsubsidised products is shown to be a key factor for maintaining future sales and therefore longer-term crowding-in. The market price will be impacted upon by a wide range of factors, including the effect the subsidy programme has on lowering costs at the level of import/domestic manufacture (in so far as they are passed on) as well as any changes to the retail market for the product in question. The possibility of increased aggregate demand affecting market prices is also left open in the diagram, as suggested by Gingrich et al. (2011a), though further research is required in this area to demonstrate concrete causal linkages.

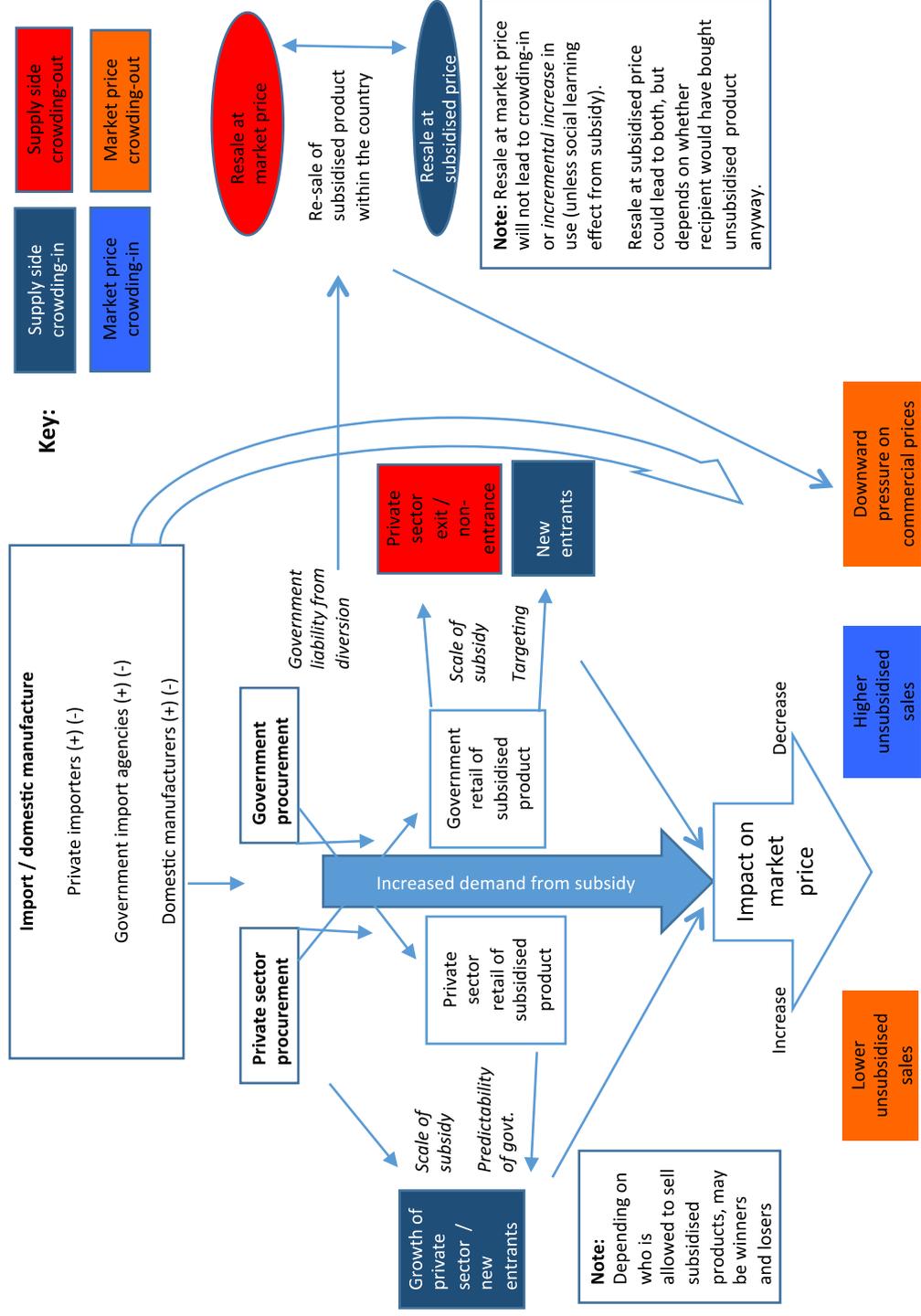


Figure 23: Impacts of large-scale product subsidies on the supply side
Note: (+) and (-) refer to positive and negative effects respectively on different actors.

7.3.3 Utility of a cross-sector approach to research

Finally, the thesis as a whole makes a contribution towards understanding the utility of a cross-sector approach to research. Three benefits in particular have been demonstrated. Firstly, exposing oneself to the literature from a different sector covering a conceptually similar programme or policy can provide an impetus for exploring research questions that may otherwise have received limited attention due to existing research or policy priorities. For example, while the question of whether partially subsidised products crowd-out unsubsidised products has received significant empirical attention in the agricultural literature due to sector-specific interests, it has received relatively little in the health sector, partly due to the overriding concern with achieving rapid short-term improvements in public health indicators. Secondly, it has been shown how drawing on the literature of more than one sector can lead to the identification of alternative or complementary methods for carrying out empirical research. These methods may help address questions from a new perspective, offer superior or different functionalities and provide new insights. Thirdly, a cross-sector approach can be useful in helping to broaden our theoretical understanding and conceptual frameworks around research issues of common interest. For example, the emphasis on the issue of social learning effects in the health literature as a potential pathway to crowding-in is something that has so far not really featured in discussions in the agricultural input subsidy literature. In addition, the thesis has clearly demonstrated the challenges and limitations of targeting in both agriculture and health sectors, raising questions over what policy options may be available in order to help address these common challenges.

7.4 Implications for policy

The fourth and final research objective of the thesis was ‘*to assess policy implications arising from the empirical findings for the design and implementation of AIS and PHPS programmes*’. This has partly already been addressed in the discussion sections of the empirical chapters. This section therefore now first briefly summarises those policy implications before drawing upon them to propose three core principles for effective design and implementation of AIS and PHPS programmes.

7.4.1 Summary of policy recommendations from empirical chapters

7.4.1.1 Targeting in the FISP

Beneficiary selection

Given the considerable challenges identified in using CBT in the FISP as a means of selecting beneficiaries and the limitations of encouraging open forums as a means to check the power of local leaders, it was argued that an alternative approach should be used for beneficiary selection in the FISP. A number of alternatives were discussed, including using a PMT approach, a combination of CBT with a PMT, or a rationed universal subsidy. Further detailed analysis should be carried out to investigate the relative benefits and costs of these alternatives in the context of the FISP, based on careful calculation of financial and other costs, including the challenges of accurate data collection. Regardless of the approach used, effective outcomes will hinge on the development and use of an appropriate national identification scheme.

Removing opportunities for rent seeking at depots

Findings of parastatal fertiliser outlets becoming key bottlenecks in the transmission of fertiliser subsidies to end users and creating opportunities for rent seeking led to the argument for making greater use of private sector delivery of subsidised inputs in the FISP, combined with appropriate government monitoring and regulation.

Ensuring effective use of subsidised inputs

From the findings in chapter 5 that some of the poorest households may struggle to make most effective use of subsidy coupons or subsidised inputs, the chapter suggested a need for greater integration with social protection measures, potentially providing the very poorest with cash transfers rather than, or in addition to, input subsidy coupons.

7.4.1.2 Crowding-in /-out and incremental coverage

The findings from chapter 6 highlighted the danger of subsidised goods reaching the very wealthiest (or more specifically those who would already purchase unsubsidised equivalents) in terms of the effects on crowding-out (or displacement) and undermining the cost-effectiveness of the programme. It was suggested that further attention could

therefore be given to targeting on the basis of which types of household do not currently purchase the products to be subsidised. However, even though up to one third of subsidised nets given to the wealthiest households crowded-out unsubsidised sales that would have gone ahead anyway, the remainder did still represent an incremental increase in ITN ownership. This point appears to have been lost in the AIS literature, where similar levels of crowding-out are viewed with great concern. This highlights the need to be very careful about excluding households on the basis of wealth indicators.

7.4.2 Three design and implementation principles for effective input subsidy and public health product subsidy programmes

Drawing on the above policy recommendations and the proposed conceptual framework on crowding-in / -out, three overarching policy recommendations emerge, cutting across the two main topics explored in the thesis.

1. Target subsidised goods to those who would not purchase unsubsidised equivalents and explore opportunities for cost-savings through shared targeting registries

It was shown in chapter 6 how subsidies reaching the wealthiest households may typically lead to the highest levels of displacement if they are the households that are more likely to purchase the goods anyway, which in turn will lower the impact a subsidy programme has on incremental coverage or use of the products being subsidised. There are likely to be considerable benefits, therefore, from making greater use of information prior to the implementation of a subsidy programme about the types of household that already purchase the goods in question. As well as helping to understand what the potential constraints to use are, which can guide the design of an appropriate policy response, it will also assist in developing targeting criteria and mechanisms for beneficiary selection. The implication is that targeting criteria will then be based less upon *a priori* assumptions about who should be targeted and more on existing evidence of demand patterns so as to maximize the impact subsidies have on increasing use of the goods being subsidised.

In order to implement this, greater focus may be needed on how to make the collection and maintenance of reliable household information financially and practically feasible. The rapid growth of a range of targeted social protection interventions in recent years, such as cash transfers and public works schemes (Garcia and Moore, 2012, IEG, 2011),

presents a number of opportunities for improving the targeting and transmission of subsidies in AISPs and PHPS programmes by harnessing cost-savings through sharing the administration of targeting activities with targeted social protection programmes. Given the potentially different eligibility criteria involved in different programmes and policies, this need not necessarily manifest itself in the provision of a single card for accessing different entitlements, as in India's Below the Poverty Line card (Ram et al., 2009). However, it could simply mean making use of shared data collection, and single registries or databases, allowing for greater use of beneficiary selection methods such as PMT that, in theory, could offer the chance for more precise targeting. While this would not remove the various challenges associated with PMT, such as gathering accurate and reliable data and keeping it up to date, it could at least make it more financially affordable.

2. Ensure that targeted beneficiaries can make effective use of subsidised products

Findings from chapter 5 also showed how at various stages in the FISP cash constraints can lead to some of the poorest households not making the most effective use of subsidy coupons or subsidised inputs. As was noted in chapter 6, in the TNVS too, poverty has been recognised as a key factor associated with non-redemption of vouchers. There could therefore be scope for significant improvements in the equity of subsidy transfer if governments were able to address these constraints, either through providing alternative forms of support (e.g. cash transfers) or coordinating programmes to ensure that the same households were also targeted with existing social protection programmes at the right time in order to alleviate their credit constraints.

3. Make use of the private sector for delivery and retail of subsidised goods

A number of findings in this thesis suggest that, for the distribution of partially subsidised products, it is important to stick to the 'market smart' principle of using the private sector in the distribution and sale of subsidised products where possible. One of the reasons given above is that it may help to reduce (though not completely eradicate) rent seeking that occurs from the bottlenecks created through the public sector. This is more likely to happen in places where use of the private sector results in local private sector competition, providing a number of sources through which coupon holders are able to procure their subsidised products. In terms of ensuring that products are locally available, the profit

incentive should go some way to encourage retailers to stock enough products in the right place at the right time as people require it. However, experience from the health sector shows that careful monitoring and regulation will still be crucial, as use of the private sector alone will not itself eliminate all diversion or ensure subsidised goods are sold at recommended prices or to the right people (Bate and Tren, 2011, Marriott, 2009). It is also important to ensure that, where the private sector does not currently have a presence, the government steps in until private outlets emerge.

A second reason for greater use of the private sector for delivery and retail is that it would substantially reduce the liabilities governments face for diversion between wholesale and retail levels, which was found to have occurred in the FISP. With public procurement from the wholesale level, any diverted inputs that are resold on the private market at market or near market rates will then likely limit the impact of a subsidy programme on incremental coverage and, in some cases, could even have a negative impact on the private sector if it pushes prices down so far as to become unprofitable for other private sector retailers (Takeshima et al., 2012). It will also limit the cost-effectiveness of the programme.

Thirdly, in implementing subsidy programmes, policy makers must not lose sight of the fact that in order to ensure continued future access to products during and beyond the life of a subsidy programme, there is a crucial need to ultimately focus on bringing down the commercial price of the products. Indeed, the high price of products is often a major reason for implementing a subsidy in the first instance and in both sectors even subsidised prices are too much for some. It is unclear how far this would be achieved on a sustainable basis without involving the private sector. As the case of the TNVS demonstrates, however, while using the private sector may be a necessary condition, it cannot be relied on in itself to keep retail costs low and care will be needed to look at the full value chain in order to see what further policies can help to bring down the commercial price of inputs or PHPs (e.g. trade facilitation and tax policy).

7.5 Limitations of the thesis

Limitations specific to each of the empirical chapters have already been raised. This section discusses a number of overarching limitations. Firstly, while the approach used in chapter 4 was useful in estimating inequality associated with direct benefit from subsidy programmes, it did not look at the socioeconomic-related inequality in terms of *all* indirect benefits (e.g. from local economy or general equilibrium effects). Similarly, the

analysis in chapter 6 estimated household-level crowding-in /-out effects of subsidised products on equivalent unsubsidised products and did not cover effects on other substitute or complementary products, or on the supply side. These all offer areas for future research.

Secondly, the quantitative and qualitative empirical work on targeting outcomes in the FISP has focused exclusively on beneficiary level targeting outcomes. While this is an area in which there was a need for an updating and deepening of analysis, there was not scope to also cover the important issue of area level targeting, which is a key area for further research. One related issue in the FISP is that the current approach to area targeting appears to be far from desirable from a purely economic or technocratic perspective in that it allocates subsidised inputs to areas without much consideration for the fact that certain areas have higher proportions of wealthier households or households that farm land which is already relatively fertile. For example, while some poorer districts such as Chikwawa, Nsanje and Machinga all had a poverty incidence above 75% according to the 2010/11 Integrated Household 3 survey, those of Nkhotakota and Kasungu were below 35% (NSO, 2012). While this does not mean that there are no poor households in the latter districts, or that even those above the poverty line will be able to afford unsubsidised fertiliser, it does serve to highlight the potential scope for further refining targeting at an area level. Under the current system, villages from areas with equal sized populations should in theory benefit equally, even if one area has a higher number of households in need of subsidised inputs. The major constraint on any policy changes in this area, however, could be the political challenge that improved area targeting can present given vested interests. However, such bold initiatives are essential for more effective public policy.

7.6 Recommendations for future research

Finally, this chapter concludes by summarising a number of key recommendations for future research. Firstly, having demonstrated the utility of using concentration curves and concentration indices to measure targeting outcomes in AISPs, these methods could be usefully applied to other AISPs to explore any cross-country differences that may exist between programmes. Where data are available, further analysis could also decompose inequalities in order to identify potential drivers through a quantitative framework.

Secondly, further research into the effect of partial ITN subsidies on unsubsidised purchases using household demand models would be very welcome as a means of

comparing against the findings in this study. In particular, the findings suggest that further research into the relative impact of free versus partially subsidised products could be useful focal point for our understanding of potentially differential impacts on future unsubsidised purchases. However, it was noted earlier how it may be difficult to capture potential social learning effects through household demand models and so these issues should also therefore receive further attention.

Thirdly, it was shown how the use of qualitative approaches can be useful in getting behind findings from the quantitative data from large household surveys, revealing new insights into issues such as how subsidy coupons and subsidised products may be used. Larger-scale qualitative research into the use of subsidy coupons and subsidised products would be welcome to get a sense of how each are actually used. This in turn would help inform choices around potential future integration with social protection measures such as cash transfers. Then, building on the findings of the thesis, further analysis should be carried out into the full costs, benefits and implications for programme impacts from adopting a PMT approach or rationed universal subsidy in Malawi's FISP, including the options for combining resources for a shared targeting approach, linked to social protection programmes.

Finally, further qualitative research would be welcome to explain household choices around future unsubsidised purchases in the context of a partial subsidy programme. This would help us to better understand the limited evidence of crowding-in. There is also a need to research the effects of crowding-in and crowding-out from the supply side by looking at how subsidy programmes are associated with the development of the private sector, including research into any causal relationship between subsidy programmes and the price of unsubsidised equivalent goods.

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Appendices

Appendix 1: Search strings used for literature search

Database: Medline (Abstract search) (Multi-field search tab)	
1	(Public health product or PHP or commodity or Oral-rehydration or ORS or Insecticide-treated or ITN or contracept* or family planning or condom or water purification or Iron supplement or artemisinin-based or artemisinin-combination or Anti-malarial or STI or sexually-transmitted or vaccin*)
2	(subsidy or subsidies or subsidi#e or subsidi#ed or subsidi#ation or demand-side financ* or voucher or social marketing or co-payment or copayment or price control or price ceiling or social franchi#e or tax relief or reimbursement or fee exemption or tax exemption or tariff removal or tariff exemption)
3	(developing countr* or low-income countr* or third world countr* or LDC or LIC or middle-income countr* or LMIC or Africa* or Asia* or Latin America or Afghanistan or Bangladesh or Benin or Burkina Faso or Burundi or Cambodia or Central African Republic or Chad or Comoros or Congo or Zaire or Eritrea or Ethiopia or Gambia or Guinea or Guinea-Bissau or Haiti or Kenya or Kyrgyzstan or Liberia or Madagascar or Malawi or Mali or Mozambique or Myanmar or Burma or Nepal or Niger or Rwanda or Sierra Leone or Somalia or Tajikistan or Tanzania or Togo or Uganda or Zimbabwe or Rhodesia or Angola or India or Sao Tome or Armenia or Iraq or Senegal or Belize or Kiribati or Solomon Islands or Bhutan or Kosovo or Sri Lanka or Bolivia or Laos or Sudan or Cameroon or Lesotho or Swaziland or Cape Verde or Marshall Islands or Syria* or Mauritania or Timor-Leste or cote or Ivory Coast or Micronesia or Tonga or Djibouti or Moldova or Turkmenistan or Egypt or Mongolia or Tuvalu or El Salvador or Morocco or Ukraine or Fiji or Nicaragua or Uzbekistan or Georgia or Nigeria or Vanuatu or Ghana or Pakistan or Vietnam or Guatemala or Papua New Guinea or West Bank or Gaza or Palestine or Guyana or Paraguay or Yemen or Honduras or Philippines or Zambia or Indonesia or Samoa or Albania or Ecuador or Namibia or Algeria or Gabon or Palau or American Samoa or Grenada or Panama or Antigua or Iran or Peru or Argentina or Jamaica or Romania or Azerbaijan or Jordan or USSR or Russia* or Belarus or Kazakhstan or Serbia or Bosnia or Latvia or Seychelles or Botswana or Lebanon or South Africa or Brazil or Libya or St Kitts or Bulgaria or Lithuania or St Lucia or Chile or St Vincent or China or Malaysia or Suriname or Colombia or Maldives or Thailand or Costa Rica or Mauritius or Tunisia or Cuba or Mayotte or Turkey or Dominica or Mexico or Uruguay or Dominican Republic or Venezuela or South Korea or Taiwan or Singapore)
4	1 and 2 and 3
Database: Medline (Keyword search) (Advanced search tab)	
5	(Public health product or PHP or commodity or Oral-rehydration or ORS or Insecticide-treated or ITNs or ITN or contracept* or family planning or condom or water purification or Iron supplement or artemisnin-based or artemisinin-combination or anti-malarial or antimalarial or STI or sexually-transmitted or vaccin*)
6	(subsidy or subsidies or subsidi#ed or subsidi#ation or demand-side financ* or voucher or social marketing or co-payment or copayment or price control or price ceiling or social franchi#e or tax relief or reimbursement or fee exemption or tax exemption or tariff removal or tariff exemption)

7	(developing countr* or low-income countr* or third world countr* or LDC or LIC or middle-income countr* or LMIC or Africa* or Asia* or Latin America or Afghanistan or Bangladesh or Benin or Burkina Faso or Burundi or Cambodia or Central African Republic or Chad or Comoros or Congo or Zaire or Eritrea or Ethiopia or Gambia or Guinea or Guinea-Bissau or Haiti or Kenya or Kyrgyzstan or Liberia or Madagascar or Malawi or Mali or Mozambique or Myanmar or Burma or Nepal or Niger or Rwanda or Sierra Leone or Somalia or Tajikistan or Tanzania or Togo or Uganda or Zimbabwe or Rhodesia or Angola or India or Sao Tome or Armenia or Iraq or Senegal or Belize or Kiribati or Solomon Islands or Bhutan or Kosovo or Sri Lanka or Bolivia or Laos or Sudan or Cameroon or Lesotho or Swaziland or Cape Verde or Marshall Islands or Syria* or Mauritania or Timor-Leste or cote or Ivory Coast or Micronesia or Tonga or Djibouti or Moldova or Turkmenistan or Egypt or Mongolia or Tuvalu or El Salvador or Morocco or Ukraine or Fiji or Nicaragua or Uzbekistan or Georgia or Nigeria or Vanuatu or Ghana or Pakistan or Vietnam or Guatemala or Papua New Guinea or West Bank or Gaza or Palestine or Guyana or Paraguay or Yemen or Honduras or Philippines or Zambia or Indonesia or Samoa or Albania or Ecuador or Namibia or Algeria or Gabon or Palau or American Samoa or Grenada or Panama or Antigua or Iran or Peru or Argentina or Jamaica or Romania or Azerbaijan or Jordan or USSR or Russia* or Belarus or Kazakhstan or Serbia or Bosnia or Latvia or Seychelles or Botswana or Lebanon or South Africa or Brazil or Libya or St Kitts or Bulgaria or Lithuania or St Lucia or Chile or St Vincent or China or Malaysia or Suriname or Colombia or Maldives or Thailand or Costa Rica or Mauritius or Tunisia or Cuba or Mayotte or Turkey or Dominica or Mexico or Uruguay or Dominican Republic or Venezuela or South Korea or Taiwan or Singapore)
8	5 and 6 and 7
Database: CAB Abstracts (Keyword search)	
9	(Agricultur* or farm)
10	((input or fertili#er or seed or pesticide or insecticide or herbicide or fungicide or irrigat* or pump or crop* or livestock or vaccin*) adj5 (subsidy or subsidies or subsidi#ed or subsidi#ation or demand-side financ* or voucher or social marketing or co-payment or copayment or price control or price ceiling or social franchi#e or tax relief or reimbursement or tax exemption or tariff removal or tariff exemption))
11	(developing countr* or low-income countr* or third world countr* or LDC or LIC or middle-income countr* or LMIC or Africa* or Asia* or Latin America or Afghanistan or Bangladesh or Benin or Burkina Faso or Burundi or Cambodia or Central African Republic or Chad or Comoros or Congo or Zaire or Eritrea or Ethiopia or Gambia or Guinea or Guinea-Bissau or Haiti or Kenya or Kyrgyzstan or Liberia or Madagascar or Malawi or Mali or Mozambique or Myanmar or Burma or Nepal or Niger or Rwanda or Sierra Leone or Somalia or Tajikistan or Tanzania or Togo or Uganda or Zimbabwe or Rhodesia or Angola or India or Sao Tome or Armenia or Iraq or Senegal or Belize or Kiribati or Solomon Islands or Bhutan or Kosovo or Sri Lanka or Bolivia or Laos or Sudan or Cameroon or Lesotho or Swaziland or Cape Verde or Marshall Islands or Syria* or Mauritania or Timor-Leste or Cote or Ivory Coast or Micronesia or Tonga or Djibouti or Moldova or Turkmenistan or Egypt or Mongolia or Tuvalu or El Salvador or Morocco or Ukraine or Fiji or Nicaragua or Uzbekistan or Georgia or Nigeria or Vanuatu or Ghana or Pakistan or Vietnam or Guatemala or Papua New Guinea or West Bank or Gaza or Palestine or Guyana or Paraguay or Yemen or Honduras or Philippines or Zambia or Indonesia or Samoa or Albania or Ecuador or

	Namibia or Algeria or Gabon or Palau or American Samoa or Grenada or Panama or Antigua or Iran or Peru or Argentina or Jamaica or Romania or Azerbaijan or Jordan or USSR or Russia* or Belarus or Kazakhstan or Serbia or Bosnia or Latvia or Seychelles or Botswana or Lebanon or South Africa or Brazil or Libya or St Kitts or Bulgaria or Lithuania or St Lucia or Chile or St Vincent or China or Malaysia or Suriname or Colombia or Maldives or Thailand or Costa Rica or Mauritius or Tunisia or Cuba or Mayotte or Turkey or Dominica or Mexico or Uruguay or Dominican Republic or Venezuela or South Korea or Taiwan or Singapore)
12	9 and 10 and 11
13	10 and 11

Source: Author. No date restrictions were imposed.

Appendix 2: Ten guiding principles for market smart subsidies

1. **Promote fertiliser as part of a wider strategy** - Increasing fertiliser use will be no magic bullet; there is a need to ensure access to complementary inputs and focus on output markets and appropriate sequencing.
2. **Favour market-based solutions** - Long-term solutions have to be market-based and interventions should be designed to support rather than undermine incentives for private sector investment and market development. Public-private partnerships may be justified as a first step towards full privatisation.
3. **Promote competition** - Competition in fertiliser (input) markets is needed to ensure the lowest cost and best quality service. Barriers to entry should be reduced.
4. **Pay attention to demand** - Farmers' effective demand (determined by current or potential profitability of fertiliser (input) use should be the ultimate driving force of input supply systems and the foundation of a sustainable fertiliser promotion strategy.
5. **Importance of economic efficiency** - fertiliser promotion should be driven by economic considerations and interventions should be carried out only where fertiliser use is economically efficient.
6. **Empower farmers** – Interventions should empower farmers to make their own decisions on the most appropriate way to manage soil fertility in their particular farming context.
7. **Devise an exit strategy** - Governments should not be involved in distributing fertiliser in the long-term and any public interventions should be designed with a clear exit strategy (except for a few long-run public-good functions like market regulation, infrastructure development, and research on natural resources management).
8. **Reaping economies of scale and scope** - Countries should seek regional integration and harmonisation of fertiliser policies to reap economies of size and scope (especially important in SSA).
9. **Ensure sustainability** - Interventions should be economically, institutionally, and environmentally sustainable.
10. **Promote pro-poor growth** – Providing that the previous nine principles are

Source: (Morris et al., 2007)

Appendix 3: Key contemporary issues, debates and questions in the literature on AISs

Topic	Issues, debates and questions
<i>Justifications and objectives of AISs</i>	There is a range of different views on what the objectives of AISs should be. Historically, much more emphasis was placed on raising aggregate production for self-sufficiency and improving overall social welfare. More recent thinking is somewhat split between emphasising poverty reduction, kick starting input supply industries, overcoming market failures, addressing environmental externalities or even as part of a policy package for wider economic growth and structural transformation.
<i>Targeting (who should be targeted and how and what targeting outcomes have been)</i>	<p>There is some debate over who should be targeted by AISs: whether it is the poorest households, food insecure households, the productive poor or those that use inputs most efficiently. Given the challenges of targeting, some have also put forward the case for rationed universal subsidies (SOAS et al., 2008). There are also problems in terms of conflicting targeting objectives, arising from conflicting programme aims. Malawi's Farm Input Subsidy Programme, for example, aims to 'improve resource-poor smallholder farmers' access to improved agricultural inputs in order to achieve their and national food self-sufficiency' (Chirwa and Dorward, 2013a). However, targeting required for maximising national food self-sufficiency may be different to that which intends to simply improve household food-security of the very resource poor and vulnerable.</p> <p>A number of studies suggest that less poor households have tended to benefit more than poorer households in recent AIS programmes (Chibwana et al., 2012, Kilic et al., 2013, Osorio et al., 2011, Ricker-Gilbert et al., 2011, Xu et al., 2009). Unequal distribution of benefits has long been a critique of AISs. What remains less clear is the distribution of benefits after taking into account the full range of wider indirect economy-wide effects. Policy questions remain over what is the best way to select beneficiaries and distribute subsidies to them. Community-based targeting has been a common approach for beneficiary identification though recent evidence raises questions over its appropriateness (Pan and Christiaensen, 2012). There are those who argue there should be greater use of more objective proxy-based tests, though acknowledge the higher costs involved (Houssou and Zeller, 2011). Others have even argued that a rationed universal subsidy may in some cases be most beneficial (Dorward and Chirwa, 2013b, Holden and Lunduka, 2012b).</p>
<i>Leakage diversion and rent-seeking</i>	Related to the issue of targeting are major challenges in the transmission of subsidies to intended beneficiaries, including scope for diversion and bribery at various levels, which can prevent access or raise the subsidised price paid by beneficiaries (Jayne et al., 2013, Mvula et al., 2011, Osorio et al., 2011). Diversion and sale of subsidised inputs can also undermine the private sector if it reduces demand for unsubsidised inputs (Mason and Jayne, 2013).
<i>Impacts on production, household income, wellbeing and other more indirect or longer-term outcomes.</i>	<p>There is little dispute that subsidies which increase the use of inputs lead to increased production, e.g. (Dorward and Chirwa, 2011c, Holden and Lunduka, 2010a, Ricker-Gilbert and Jayne, 2011). How much increased (incremental) production there is, however, depends on a wide range of factors including targeting outcomes, agro-ecological conditions, whether subsidies crowd-out unsubsidised purchases that would have gone ahead anyway (see below), research and extension services, and favourable soils and weather.</p> <p>There is evidence that some AISs have led to increased food security and household incomes of beneficiaries and some evidence of increasing rural wages (Dorward and Chirwa, 2011c, Holden and Lunduka, 2010a, Karamba, 2013). However, other studies failed to find evidence of longer-term increased household wealth (Holden and Lunduka, 2010a, Ricker-Gilbert and Jayne, 2011). A key area of further research would therefore be to look at the obstacles preventing further building up of assets and wealth by beneficiary households and the conditions under which this is more likely to arise. There is very limited evidence on health-related impacts of AISs. That which exists suggests some positive effects (Karamba, 2013).</p> <p>In terms of wider economic impacts, there remain significant gaps in our knowledge. Some evidence using modelling approaches does highlight the potential for input subsidies to have large welfare multipliers (Arndt et al., 2013, Filipski and Taylor, 2012). Dorward and Chirwa (Dorward and Chirwa, 2013a) use a partial equilibrium model of the informal rural economy and estimate multipliers of 1.5 and 2.5 in two different</p>

	<p>livelihood zones in Malawi. In terms of staple prices, the limited evidence finds that maize fertiliser subsidies have had minimal impact on reducing maize prices (Ricker-Gilbert et al., 2013b). Part of the reason for this is likely to be due to non-complementary grain trade policy. However, there is some evidence of Malawi's FISP having small but significant impacts on local wages (Ricker-Gilbert, 2011) and even on real wages (Dorward and Chirwa, 2011b, Dorward et al., 2013).</p>
<p><i>Impacts on the private sector, including sales of unsubsidised inputs: do AISs crowd-in or crowd-out commercial purchases?</i></p>	<p>There has been limited investigation into the broader economy-wide effects of subsidy programmes on private input market development with a few exceptions (Chirwa and Dorward, 2013b). The main evidence has therefore tended to come from studies looking at whether and when AISs crowd-out (displace) or crowd-in (stimulate) unsubsidised commercial sales of the input being subsidised at the household level. Aside from the impact on the private sector, levels of crowding-out are recognised to determine the impact AISs have on total incremental use of the product being subsidised, the private input sector and cost-effectiveness (SOAS et al., 2008). Much evidence on subsidised fertiliser has pointed to crowding-out taking place due to weak targeting, though there is some limited evidence of crowding-in (Jayne et al., 2013, Liverpool-Tasie et al., 2010, Ricker-Gilbert et al., 2011, Takeshima et al., 2012, Xu et al., 2009). There remain questions therefore over the conditions under which crowding-in could be further encouraged.</p> <p>One study on the effects of improved maize seed subsidies in Malawi and Zambia also finds evidence of crowding-out in both cases (Mason and Ricker-Gilbert, 2012). However, there is also evidence of growing commercial purchases of seeds in Malawi's FISP (Dorward et al., 2013).</p>
<p><i>Environmental impacts, including crowding-in or crowding-out of organic manure.</i></p>	<p>Another longstanding debate, on fertiliser subsidies in particular, is over the potentially negative impacts of encouraging increased use of inorganic fertilisers. On the one hand it is fairly widely recognised that fertilisers are an important part of combatting lack of soil fertility (Morris et al., 2007). On the other, there are those who have suggested that overuse of inorganic fertilisers and intensive farming may lead to a decline in soil matter and negative environmental externalities (GRAIN, 2010). However, the evidence for this remains somewhat unclear and overuse is less of a concern in most LIC contexts given that it is substantial underuse that is the key policy problem.</p> <p>Given the above, an interesting question has been raised over whether subsidies for inorganic fertiliser crowd-in or crowd-out the use of organic fertiliser. The limited empirical evidence carried out in study sites in Malawi suggests crowding-in rather than crowding-out was taking place between 2006 and 2009 (Holden and Lunduka, 2010b, Holden and Lunduka, 2012a).</p>
<p><i>Crop simplification or diversification?</i></p>	<p>Whether AISs for specific fertiliser and seed encourage specialisation or diversification of crops has been the topic of some debate. There is some evidence to suggest subsidies for maize fertiliser may encourage allocation of larger amounts of land to maize (Chibwana et al., 2012). However, other evidence suggests that subsidised maize fertiliser may have actually encouraged diversification by increasing productivity and yields, meaning the same amount of maize can be grown on a smaller plot of land (Dorward et al., 2013, Holden and Lunduka, 2010b: 29, Karamba, 2013). Evidence on longer-term economy-wide agricultural diversification suggests that over the duration of the FISP in Malawi a declining proportion of landholdings were under maize cultivation (Dorward et al., 2013).</p>
<p><i>Relative returns to AISs compared to other policies or investments</i></p>	<p>While most current thinking recognises a potential role for AISs, a key debate centres on how much priority they should be given relative to other policies and investments. There is growing acceptance in many quarters, for example, that expenditure on AISs may be crowding-out necessary investments in other areas (CISANET, 2014, Jayne and Rashid, 2013). How to maintain an appropriate balance remains a key question and practical policy challenge.</p> <p>In order to try and quantify the returns to AISs, a number of studies have estimated benefit-cost ratios, though they are highly sensitive to which benefits and costs are included and to yield responses to fertilisers (Chirwa and Dorward, 2013a, Dorward and Chirwa, 2011a, Jayne et al., 2013). The desirability of AISs as a policy option relative to other government policies (e.g. investments in infrastructure or research and extension) remains a contentious issue. While some argue that other investments will yield greater returns, e.g. (Osorio et al., 2011), the evidence remains limited and is likely to vary with contexts and with the relative size and design and implementation efficiency of different</p>

	<p>programmes. For example, one modelling study found input subsidies to be more welfare-efficient than cash transfer programmes in Malawi under certain conditions (Filipski and Taylor, 2012). One study estimated that returns to agricultural growth and poverty reduction from fertiliser subsidies in India from the 1960s to 1990s were consistently lower than roads and education, but varied over time (Fan et al., 2007). However, it is problematic to consider returns to different investments without considering potential complementarities and dependencies between them, and outcomes will ultimately differ depending on conditions and context.</p>
<p><i>Achieving graduation and exit from subsidies</i></p>	<p>It is generally recognised that political demands can tend to lead to input subsidies persisting over time even when they may not be required any longer (Osorio et al., 2011). Knowing when exactly they are no longer required, how to ensure beneficiaries can and do graduate away from subsidised inputs to full cost inputs and how to eventually exit from the programme remain major questions (Chirwa et al., 2011a). While the market smart approach and other perspectives suggest subsidies must be time limited, there is some lack of clarity over when exactly subsidies should be removed and what the criteria for their removal should be. The lack of clarity regarding duration is further complicated from the competing ideas of what should be the principal policy objectives of AISs.</p>

Source: Author.

Appendix 4: Key contemporary issues, debates and questions in the literature on PHPSs

Topic	Issues, debates and questions
<i>Full or partial subsidies: how to most effectively reach intended beneficiaries, especially the poorest and most in need?</i>	<p>There has been much empirical analysis concerning the extent to which PHPS programmes have led to improvements in equity of access or use. Debate has centred on how best to achieve improvements in equity. Some have noted that 'even free public sector interventions often fail to reach the poor' and that '[m]aking greater use of the commercial sector for the distribution of nets could conceivably prove more sustainable and less expensive' (Hanson et al., 2003: 274). However, some authors highlight the need for more rapid increases in coverage of some PHPs such as ITNs to achieve global targets and have shown that mass free campaigns can be effective in achieving rapid increases in equitable coverage (Grabowsky et al., 2005, Noor et al., 2007). The lure of fully subsidised PHPs might appear stronger in the light of recent studies that suggest even highly subsidised PHPs may still remain out of reach for the poorest and most vulnerable or remote (Cohen et al., 2010, Hanson et al., 2009, Sabot et al., 2009) and a review of 20 African ITN studies that found the strategies achieving high ownership and use among children under five delivered ITNs for free through campaigns (Willey et al., 2012).</p> <p>One debate relating to the use of full subsidies has been over whether or not people will use free nets as effectively as if they were made to pay at least a nominal amount for them. While Marin et al. found nets that were paid for were used more often, evidence by Maxwell et al. and Cohen and Dupas suggests that free nets are not used less than those that are paid for (Cohen and Dupas, 2010, Marin et al., 2005, Maxwell et al., 2006). Today the debate has moved beyond whether full or partial subsidies are better, towards the recognition that some combination of full and partial subsidies is likely to be most effective in achieving 'catch-up' and 'keep-up' of coverage over the longer-term (Baume and Marin, 2008, Grabowsky et al., 2007, Koenker et al., 2013). Questions remain, however, over what the appropriate balance between the two might look like in particular contexts, and evidence suggests appropriate sequencing between the two will also be crucial (Snow et al., 1999). Within the catch up and keep up debate, recent studies have also focused on the impact that free nets may have on partially subsidised sales, with some studies finding no effect and one indicating they may reduce partially subsidised sales (Eze et al., 2014, Gingrich et al., 2011b, Gingrich et al., 2014).</p>
<i>Effective and appropriate use of subsidised PHPs</i>	<p>It is recognised for many PHPs that access is very different to effective use, which is essential for ensuring intended health outcomes. As such, various research has recently looked at how subsidised PHPs have been used, whether it is adherence to a programme of medication (Bruxvoort et al., 2014) or appropriate use of ITNs (Hanson et al., 2009, Marchant et al., 2010). These findings can help provide policy guidance on design and implementation features that are important for effective use.</p>
<i>Impacts on private provision of PHPs.</i>	<p>Another emerging debate has been over whether the distribution of free ITNs will undermine commercial markets and therefore longer-term access and future sustainability (Noor et al., 2007). It has been suggested that negative effects of free campaigns may arise either through the supply-side (by discouraging private sector provision in the presence of subsidies) or on the demand-side (by displacing commercial purchases that would otherwise have gone ahead, or if subsidies distort the recipients' views on the value of the product by making them undervalue the actual price that they should pay in the future) (Gingrich et al., 2011a: 162).</p> <p>Hanson et al. have suggested that the crowding-out of commercial sales from free or very low cost PHPs is likely to vary considerably by context and there may well be cases where subsidies instead crowd-in the private sector, especially in the presence of low levels of private sector development or PHP use (Hanson et al., 2001: 129). Others have suggested that crowding-in may arise if experience of using the subsidised PHP is linked to improved health outcomes in the minds of the users, in which case subsidies may stimulate additional purchases in the long-run and be considered an 'experience good' (Dupas, 2010). However, there remains very little empirical evidence regarding commercial crowding-out.</p>
<i>Cost-effectiveness</i>	<p>An important debate within the literature concerns the level of cost-effectiveness of different PHPS programmes. Part of this comes out of the full versus partial subsidy debate above. Some studies have suggested that particular social marketing approaches can be more cost-effective in terms of averted deaths compared to free campaigns (Hanson et al., 2003). There has also been a large scale review of the cost-effectiveness of different delivery strategies for ITNs (Willey et al., 2012). The general findings of that study were that costs</p>

	<p>are largely comparable across the three main delivery strategies (partial subsidies through retail outlets, full subsidies through antenatal clinics and full subsidies through large-scale campaigns). Cost-effectiveness estimates were most sensitive to assumptions around ITN lifespan and leakage.</p>
<p><i>Challenges in using and appropriate use of the private sector.</i></p>	<p>There is a major interest in how to ensure that PHPSs delivered through the private sector help achieve public health goals. While it is recognised that using the private sector can help improve access and use, there remains limited rigorous evidence relating to their full impacts (Montagu et al., 2014).</p> <p>The recent AMF-m programme has attracted particular criticism in certain quarters. On one side of the debate some argue that the model has led to a significant increase in the availability of improved and affordable ACTs, along with crowding-out of inferior monotherapies (Sabot et al., 2009). On the other, critics have argued that, although there are now more ACTs in LICs and MICs, the model of the AMF-m programme has not always brought about the intended price reductions, that there has been diversion and cross-border leakage benefiting middlemen, that poor targeting exists including to those who do not need ACTs, and that globally the programme has not allocated a limited global supply in the most efficient way (Bate and Tren, 2011).</p> <p>A further criticism of the AMF-m and of PHPSs that are delivered through the private sector in general, is that providing subsidies in this way shifts much needed resources away from investing in public health care services, which may be better suited to meeting the health needs of populations due to the range of perverse incentives that arise out of the private sector being concerned primarily with profit-maximisation (Marriott, 2009).</p>

Source: Author.

Appendix 5: Studies on equity outcomes of public health product subsidies

Study	Country and commodity	Measurement of equity	Methodology	Data	Main findings
(Njau et al., 2009)	Tanzania (ITNs)	Socioeconomic distribution of the ownership of nets examined using an asset-based index.	Change in equity ratios over time was compared.	Two stage cross-sectional survey of women of child-bearing age.	Improvement of 0.27 (from 0.21 in Feb to May 2005 to 0.48 in June to Sept 2005).
(Grabowsky et al., 2007)	Ghana (ITNs)	Socioeconomic distribution of the ownership and use of nets examined using an asset-based index. Use was among children.	Change in equity ratio over time compared.	Two separate population-based surveys.	Slight decline of 0.06 for ownership and a 0.16 improvement in use (though this was 38 months following a mass free bed net campaign which brought about high and equitable levels of ownership and use).
(Agha et al., 2007)	Zambia (ITNs)	Socioeconomic distribution of a range of outcomes (e.g. use of nets, access time, and number of nets owned) examined using an asset-based index.	Concentration indices for intervention and control districts are compared. Also examine distribution of benefits of the intervention among SES groups and test for interactions between SES and intervention status.	One-off household survey data.	Statistically significant lower index scores (greater equity) in intervention districts compared to comparison for range of outcomes, including: 'Access to nets in 15 minutes or less', 'Number of ITNs owned by household', 'Usually sleeps under a net'.
(Hanson et al., 2009)	Tanzania (ITNs)	Socioeconomic distribution of the use of nets among children under 1 year old examined using an asset-based index.	Change in equity ratio throughout programme.	Three nationally-representative cross-sectional household and facility surveys (early, mid-way and end of programme).	Improvement of 0.18 from 2005 to 2007.
(Noor et al., 2007)	Kenya (ITNs)	Socioeconomic distribution of use among under-5s examined using an asset-based index.	Concentration indices compared over time.	Longitudinal repeated cross-sectional surveys.	Improvement of 0.281 in concentration index (0.281 in 2004, 0.131 in 2005, and 0.000 in 2006).
(Kangwana et al., 2011)	Kenya (Artemether Lumefantrine)	Socioeconomic distribution of receipt of AL among children aged 3-59 months examined using an asset-based index.	Test for interaction between wealth quintiles and intervention at follow-up.	Cross-sectional household surveys before and after intervention.	No statistical correlation between wealth and probability of receiving any brand or subsidised brand of AL on same or following day of fever developing.
(Sabot et al., 2009)	Tanzania (ACTs)	Socioeconomic distribution of treatment	Comparison of proportion of purchases of AL	Repeated exit interviews before and	No correlation between the SES of the consumer and the

		<p>seeking examined based on (shorted questionnaire) concerning household assets. Geographical equity of access examined based on stocking by location. Equity of price paid by SES quintile and location examined.</p>	<p>compared to other anti-malarial treatments by SES. Comparison of stocking levels by competition category (based on number of nearby shops). Comparison of prices paid by SES and competition category.</p>	<p>during intervention.</p>	<p>likelihood of buying ACTs (44.4% of purchases by consumers in the poorest two quintiles and 42.4% by those in the least poor quintiles). However, poorer individuals sought treatment substantially less frequently than wealthier ones. Proportion of shops with 2 or more others nearby more likely to stock than those with 0-1 competitors ($p<0.001$). Price paid did not vary significantly by either the SES quintile of the consumer or the competition category (remoteness) of the shop.</p>
(Rutta et al., 2011)	Tanzania (ACTs)	Uptake / availability by district examined.	Comparison of uptake by geographic location.	Drug register data from outlets.	Substantial variation among districts in uptake of ACTs (10% of all sales in Kilombero compared to 47% in Morogoro).
(Wang et al., 2011)	Nepal (Zinc supplement)	Socioeconomic distribution of use by children examined with asset wealth index.	Used multiple logistic regression analysis on use to identify statistically significant predictors, including SES. Odds ratios calculated.	One-off household survey.	Children in the highest wealth quintile more likely to be treated with zinc than children in the lowest quintile (odds ratio=5.76, $p<0.05$). Children whose caregivers had secondary education or higher were also more likely to be treated with zinc (OR=1.76, $p<0.05$).

Source: Systematic search and review of impacts carried out by the author.

Appendix 6: Working with dichotomous variables when calculating concentration indices

A longstanding debate has taken place over the best way of dealing with a dichotomous outcome variable when calculating CIs (Erreygers, 2009a, Wagstaff, 2005), though there is at least agreement that such variables can be used (Wagstaff, 2011).

One of the main problems is that the bounds are no longer between -1 and 1, but depend on the mean value of the outcome variable (Wagstaff, 2005). This makes comparison of indices across countries problematic if there are large differences in the average outcomes. The original proposal by Wagstaff (2005) aimed to address the issue by normalising the CI. It was suggested this could be done by dividing the CI by the upper bound, which in the case of a binary outcome variable is given by $1 - \mu$, where μ is the sample mean of the outcome (Equation 10).

$$CI_n = \frac{CI}{1 - \mu}$$

Equation 10: Wagstaff's Normalisation

An alternative correction to the standard CI was proposed by Erreygers, which has been summarised by Wagstaff (2009) as:

$$E_c = \left(\frac{4\mu b - a}{b - a} \right) \cdot C$$

Equation 11: Erreygers' correction

where E_c is Erreygers' correction, C is the standard CI, μ is the mean of the outcome variable and b and a are the upper and lower bounds of the outcome variable.

An extensive debate has ensued over which approach is most appropriate, with Wagstaff arguing that Erreygers' correction may be driven more by an attempt to measure absolute inequality rather than relative inequality (Wagstaff, 2009). Erreygers has also criticised Wagstaff's normalisation for inflating CIs in cases where mean values are high (Erreygers, 2009b).

Appendix 7: Summary of variables used for Principal Component Analysis

Variable	2006/07			2008/09			2012/13		
	Mean	SD	Scoring coefficient	Mean	SD	Scoring coefficient	Mean	SD	Scoring coefficient
Rained land (hectares)	1.10	1.59	0.12	1.24	1.53	0.16	1.03	1.33	0.13
Dimba land (hectares)	0.16	0.40	0.06	0.16	0.72	0.02	0.13	0.30	0.03
Axes	0.86	0.84	0.25	0.90	0.88	0.25	0.74	0.83	0.24
Beds	0.47	0.88	0.30	0.64	0.98	0.30	0.49	0.83	0.29
Bicycles	0.47	0.67	0.26	0.57	0.78	0.26	0.58	0.75	0.27
Chairs	1.7	2.41	0.33	2.02	2.59	0.33	1.41	2.19	0.32
Hoes	2.70	1.89	0.27	2.96	2.06	0.27	2.73	1.63	0.26
Irrigation	0.13	0.55	0.12	0.23	0.74	0.13	0.17	0.60	0.10
Lanterns	0.5	0.73	0.20	0.60	0.76	0.24	0.22	0.53	0.15
Mortar and Pestles	0.83	0.85	0.20	0.90	0.93	0.22	0.79	1.08	0.19
Pangas	0.77	0.78	0.23	0.84	0.89	0.20	0.79	0.73	0.22
Radios	0.69	0.77	0.27	0.73	0.95	0.23	0.52	0.66	0.24
Sickles	0.68	0.76	0.18	0.84	0.94	0.21	0.68	0.91	0.17
Tables	0.47	0.74	0.32	0.58	0.81	0.31	0.42	0.72	0.31
Cattle	0.17	0.97	0.14	0.43	1.82	0.17	0.45	2.58	0.17
Goats or sheep	1.83	52.28	0.03	1.30	2.88	0.17	1.25	2.94	0.19
Pigs	0.29	1.23	0.11	0.39	1.44	0.11	0.41	1.61	0.12
Poultry	4.78	19.52	0.10	6.04	26.28	0.07	4.04	6.06	0.24
Walls are concrete, burnt brick or wooden	0.38	0.49	0.22	0.49	0.50	0.19	0.49	0.50	0.22
Roof is iron, clay or concrete	0.24	0.43	0.24	0.29	0.45	0.23	0.26	0.44	0.25
Floor is smooth cement, wooden or tiled	0.17	0.37	0.26	0.22	0.41	0.24	0.12	0.31	0.22

Source: Author's calculations. Note: First principal component accounted for 23% (2006/07), 24% (2008/09) and 22% (2012/13).

Appendix 8: Number of households interviewed by district

District	AISS-1	AISS-2	FISS-4
Northern			
Chitipa	100	120	100
Karonga	98	120	120
Nkhata Bay	109		
Rumphi	103		
Mzimba	119	140	140
Central			
Kasungu	134	140	100
Nkhotakota	120	120	120
Ntchisi	120		
Dowa	128		
Salima	103		
Lilongwe	137	160	300
Mchinji	120		
Dedza	160	159	80
Ntcheu	139	140	120
Southern			
Mangochi	172	181	240
Machinga	139		100
Zomba	157	160	
Chiradzulu	120		
Blantyre	126	139	140
Mwanza	109		
Thyolo	148	143	221
Mulanje	140		
Phalombe	120	120	80
Chikwawa	140	140	140
Nsanje	119		
Balaka	118		
Neno			
Total	3,298	1,982	2,001

Source: AISSs (2006/07 and 2008/09) and 2012/13 FISS.

Appendix 9: Frequency of households interviewed by livelihood zone

Livelihood zone	Sample households		
	AISS-1	AISS-2	FISS-4
Chitipa Maize and Millet	84	100	100
Misuku Hills	16	20	
Northern Karonga	32	40	40
Central Karonga	34	40	40
Nkhata Bay Cassava	117	40	40
Western Rumphu and Mzimba	102	40	40
Mzimba Self-Sufficient	86	100	100
Northern Lakeshore	178	120	120
Kasungu-Lilongwe Plain	719	399	400
Rift Valley Escarpment	228	120	120
Southern Lakeshore	105	60	80
Border Productive Highlands	114	204	80
Shire Highlands	371	80	221
Pirilongwe Hills	77	80	80
Lake Chilwa - Phalombe Plain	357	180	180
Middle Shire	251	99	100
Lower Shire	259	14099	140
Thyolo-Mulanje Tea Estates	168	120	120
Total households	3,298	1,982	2,001

Source: AISSs (2006/07 and 2008/09) and 2012/13 FISS

Appendix 10: Attrition and its relationship to wealth in the subsidy allocation-use process (2006/07)

	Received at least a share of one fertiliser voucher		Successfully used all fertiliser vouchers to buy subsidised fertiliser		No reported other use for all subsidised fertiliser	
	%	N	%	N	%	N
All households	56.2 [53.1, 59.4]	3298	95.7 [94.3, 96.8]	1817	96.1 [94.8, 97.0]	1760
Quintile 1 (poorest)	40.5 [35.3, 45.9]	659	94.5 [90.6, 96.8]	265	94.4 [90.9, 96.6]	253
Quintile 2	55.1 [49.1, 61.0]	660	92.8 [88.5, 95.6]	342	97.6 [95.5, 98.7]	329
Quintile 3	56.9 [52.2, 61.5]	659	96.2 [93.5, 97.8]	367	96.1 [93.1, 97.8]	354
Quintile 4	62.2 [57.5, 66.7]	660	95.9 [92.9, 97.7]	407	97.0 [94.6, 98.4]	394
Quintile 5 (wealthiest)	66.9 [61.3, 72.1]	660	98.2 [95.8, 99.2]	436	97.6 [95.7, 98.7]	430
Male-headed	59.4 [55.7, 62.9]	2433	95.7 [93.9, 97.0]	1407	96.6 [95.4, 97.6]	1365
Female-headed	47.4 [43.4, 51.5]	865	95.6 [92.7, 97.4]	410	97.0 [94.8, 98.3]	395
Hh size						
1-3	48.1 [44.0, 52.3]	786	96.4 [93.8, 97.9]	380	95.2 [92.7, 96.9]	369
4-6	57.2 [53.1, 61.3]	1614	95.2 [93.0, 96.7]	901	96.2 [94.5, 97.4]	867
>6	61.6 [57.1, 65.8]	898	96.1 [93.6, 97.7]	536	98.5 [97.3, 99.2]	524
Land size						
Up to 0.499 ha	50.5 [45.1, 56.0]	689	95.1 [92.0, 97.0]	337	94.0 [90.5, 96.3]	323
0.5 to 0.99 ha	54.1 [50.1, 58.1]	883	96.5 [93.5, 98.1]	472	95.9 [93.2, 97.6]	458
1 to 1.99 ha	61.9 [57.9, 65.7]	1040	95.9 [93.6, 97.3]	621	98.1 [96.4, 99.0]	603
2 ha and above	56.6 [50.2, 62.8]	686	95.0 [91.7, 97.1]	387	97.9 [95.8, 98.9]	376
No livestock	44.9 [40.9, 49.0]	1063	95.0 [92.6, 96.7]	456	96.7 [94.6, 98.0]	437
Own livestock	62.0 [58.6, 65.3]	2235	95.9 [94.2, 97.2]	1361	96.7 [95.3, 97.7]	1323
Northern	64.7 [58.1, 70.9]	529	93.3 [85.0, 97.2]	325	98.4 [96.1, 99.3]	316
Central	57.7 [51.7, 63.5]	1161	97.2 [94.9, 98.5]	655	98.2 [96.4, 99.1]	645
Southern	53.2 [49.4, 56.9]	1608	94.9 [92.9, 96.4]	837	94.8 [92.8, 96.3]	799

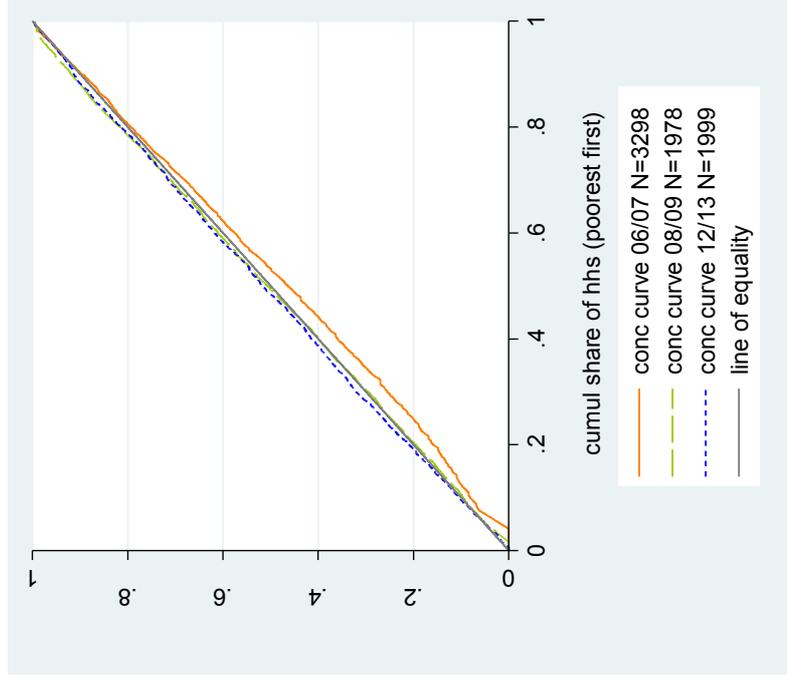
Source: AISS 2006/07.

Appendix 11: Attrition and its relationship to wealth in the subsidy allocation-use process (2008/09)

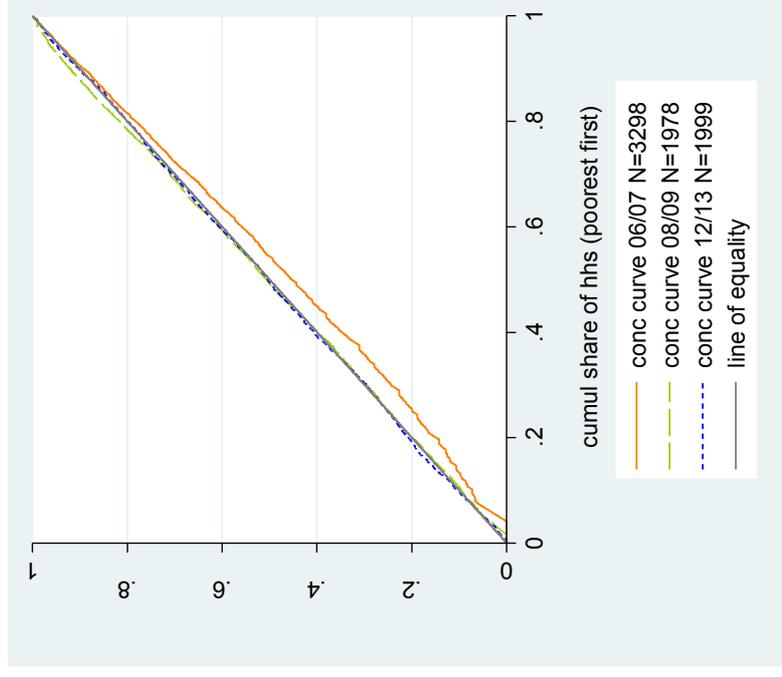
	Received at least a share of one fertiliser voucher		Successfully used all fertiliser vouchers to buy subsidised fertiliser		No reported other use for all subsidised fertiliser	
	%	N	%	N	%	N
All households	70.7 [66.4, 74.6]	1982	96.7 [95.0, 97.8]	1386	90.9 [88.1, 93.1]	1360
Quintile 1 (poorest)	61.9 [56.2, 67.3]	396	93.4 [88.7, 96.2]	233	86.8 [80.2, 91.4]	220
Quintile 2	72.8 [66.5, 78.2]	396	97.3 [94.2, 98.8]	278	88.3 [80.5, 93.2]	275
Quintile 3	72.9 [67.3, 77.8]	397	97.0 [93.8, 98.6]	286	95.5 [92.0, 97.6]	283
Quintile 4	73.7 [63.0, 82.2]	396	97.5 [94.2, 98.9]	290	94.7 [90.1, 97.3]	287
Quintile 5 (wealthiest)	73.1 [65.6, 79.4]	397	98.0 [95.3, 99.1]	299	94.2 [90.4, 96.6]	295
Male-headed	70.3 [65.4, 74.7]	1454	96.9 [95.0, 98.1]	1017	92.8 [89.9, 95.0]	998
Female-headed	71.7 [66.4, 76.5]	521	96.0 [92.8, 97.8]	363	89.8 [83.7, 93.8]	356
Hh size						
1-3	71.7 [66.7, 76.3]	398	95.7 [91.5, 97.9]	278	87.0 [80.0, 91.8]	270
4-6	69.4 [63.7, 74.6]	958	97.6 [95.4, 98.7]	660	91.3 [87.6, 93.9]	652
>6	72.0 [66.7, 76.7]	626	95.9 [93.1, 97.6]	448	96.2 [92.8, 98.0]	438
Land size						
Up to 0.499 ha	57.6 [45.5, 68.8]	351	95.6 [92.3, 97.5]	199	84.8 [78.7, 89.4]	193
0.5 to 0.99 ha	69.2 [63.9, 74.0]	521	97.2 [95.0, 98.5]	357	91.3 [87.5, 94.0]	350
1 to 1.99 ha	73.4 [69.2, 77.3]	714	96.2 [92.8, 98.0]	516	93.7 [89.5, 96.3]	507
2 ha and above	81.1 [76.3, 85.1]	396	97.6 [94.5, 99.0]	314	94.8 [90.3, 97.2]	310
No livestock	63.6 [57.1, 69.6]	535	94.3 [90.9, 96.5]	323	88.2 [82.8, 92.1]	311
Own livestock	73.5 [69.4, 77.3]	1446	97.5 [95.8, 98.5]	1062	93.2 [89.9, 95.5]	1048
Northern	78.9 [70.6, 85.3]	380	98.7 [95.0, 99.6]	297	96.9 [92.7, 98.7]	296
Central	70.2 [64.2, 75.6]	719	96.5 [93.5, 98.2]	482	91.7 [86.2, 95.1]	467
Southern	69.3 [62.1, 75.7]	883	96.3 [93.3, 97.9]	607	90.9 [86.2, 94.1]	597

Source: AISS 2008/09.

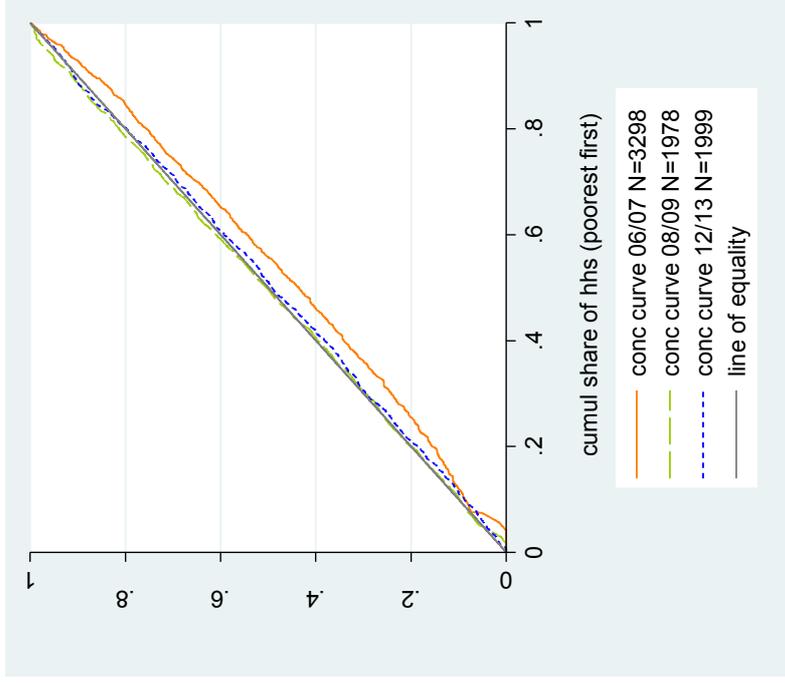
Appendix 12: CCs and CIs using household income and household income per capita



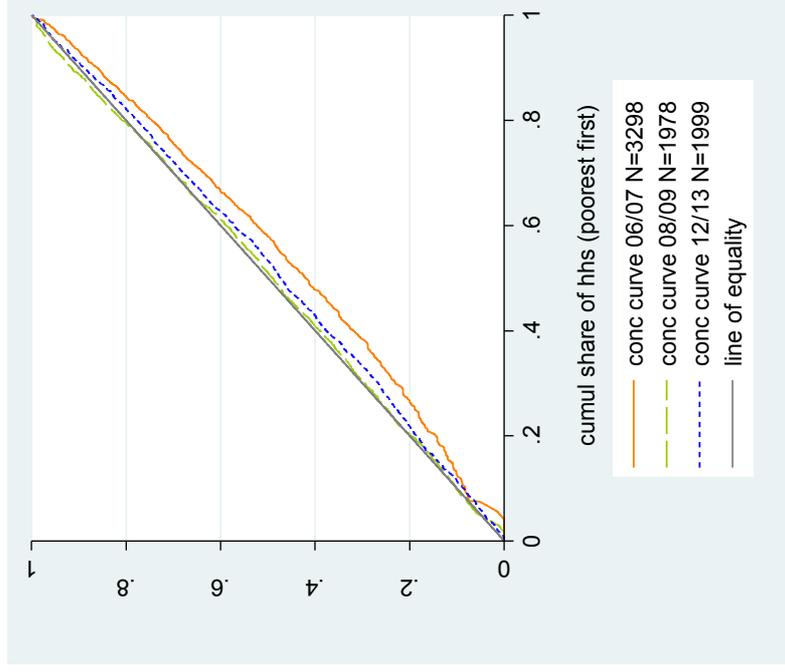
**Receipt of any fertiliser coupon
(per capita household income)**



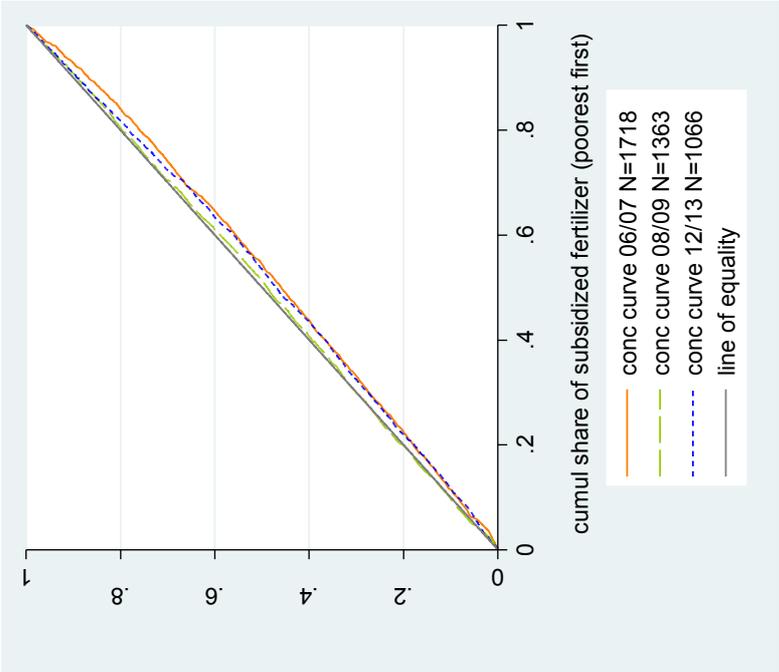
**Receipt of any fertiliser coupon
(household income)**



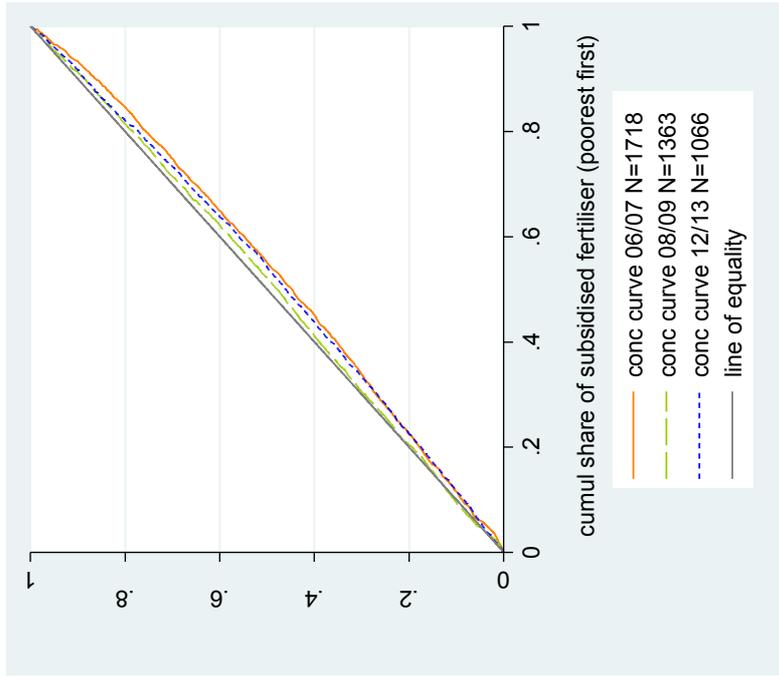
**Number of fertiliser coupons received
(per capita household income)**



**Number of fertiliser coupons received
(household income)**



**Volume of subsidised fertiliser received
(per capita household income)**



**Volume of subsidised fertiliser received
(household income)**

Concentration indices for households ranked by household income and income per capita

Outcome indicator	Year	Concentration index [95% confidence intervals]		
		Wealth index	Household income	Per capita income
<i>Receipt of any fertiliser coupon (D)</i>	2006/07	0.20* [0.18, 0.22]	0.14* [0.12, 0.16]	0.10* [0.08, 0.12]
	2008/09	0.09* [0.06, 0.11]	-0.03 [-0.06,-0.01]	-0.03 [-0.06, -0.01]
	2012/13	0.08* [0.05, 0.10]	-0.02 [-0.04,-0.01]	-0.05* [-0.08, -0.03]
<i>Number of fertiliser coupons</i>	2006/07	0.19* [0.15, 0.22]	0.11* [0.07, 0.15]	0.08* [0.04, 0.13]
	2008/09	0.10* [0.08, 0.13]	0.00 [-0.03, 0.03]	-0.01 [-.041, 0.02]
	2012/13	0.09* [0.06, 0.12]	0.04* [0.01, 0.07]	0.02 [-.013, 0.04]
<i>Redeemed all fertiliser coupons (D)</i>	2006/07	0.04* [0.03, 0.04]	0.03* [0.02, 0.03]	0.02 [0.02, 0.03]
	2008/09	0.03* [0.02, 0.04]	0.01 [0.00, 0.02]	0.01 [0.00, 0.01]
	2012/13	0.02 [0.01, 0.03]	0.02 [0.01, 0.04]	0.02 [0.01,0.03]
<i>Volume of subsidised fertiliser acquired</i>	2006/07	0.12* [0.09, 0.14]	0.07* [0.05, 0.09]	0.06* [0.04, 0.08]
	2008/09	0.09* [0.07, 0.11]	0.02* [0.00, 0.04]	0.01 [-0.01, 0.03]
	2012/13	0.06* [0.04, 0.08]	0.05* [0.03, 0.07]	0.04* [0.03, 0.06]
<i>No 'other use' of fertiliser (D)</i>	2006/07	0.01 [0.00, 0.02]	0.00 [0.00, 0.01]	-0.01 [-0.01,0.00]
	2008/09	0.07* [0.06, 0.08]	0.03 [0.02, 0.04]	-0.00 [-0.01, 0.01]
	2012/13	-0.02 [-0.02,-0.01]	-0.01 [-0.01, 0.00]	-0.01 [-0.02, 0.00]

Source: Author's calculations. Note: For the dichotomous outcome indicators (D), Erreygers' correction is used to standardise them. * Indicates CIs were statistically different from zero (i.e. perfect equality) at the 5% significance level.

Appendix 13: Example template of semi-structured interview questions

Note: Module B2 shown here followed Module A on household characteristics and B1 on coupons. Extended answer sections for other respondents (e.g. MoAFS staff) were adapted accordingly.

MODULE B2 (extended answer section): Smallholder farmers Person ID: _____

A7b. List any livestock owned and numbers

CHICHEWA A7b. Munganditchulireko ziweto zina zili zonse zimene muli nazo ndi kuti zilipo zingati?

B5. Have you heard of anyone having to pay for coupons that they were allocated this last agricultural season?

- Do you know anyone personally who had to pay for a coupon they were allocated?
- Did you pay for a coupon you were allocated?
- If so, how much did you pay for each coupon?
- You do not need to give specific names but can you describe who the payment was made to?

CHICHEWA B5. Munayamba mwamvapo kuti wina wake amagula ma kuponi amene anapelekedwa muulimi wapitawu?

- Pali amene mukumudziwa amene anagula ma kuponi yoti inaperekedwa kale?
- Nanga inuyo munagulapo kuponi yoti inali itaerekedwa?
- Ngati ndi choncho, munagula ndalama zingati pa kuponi imodzi?
- Simukuyenera kutchula maina, koma mungandilongosolele kuti ndalama zinapatsidwa kwa ndani?

B7A. (If any coupon was redeemed) How did you afford/ obtain the money for buying the inputs (if more than one source, note the order of importance)?

CHICHEWA B7A. (If any coupon was redeemed) Munakwanitsa bwanji kupeza ndalama zogulira zipangizo (fert and seed) (if more than one source, note the order of importance)?

B7C. For each coupon you did not redeem, what was the main reason for not redeeming it (fill in table)?

- Were there any other reasons that made you choose not to redeem the voucher?
- Was your personal safety ever a concern when deciding whether or not to go to the shop with your coupon?
- Within your household, how is it decided what will be done with subsidy coupons?

CHICHEWA B7C. Pa coupon ina ili yonse imene simunagwiritse ntchito kugulira zipangizo zotsika mtengo, ndi zifukwa zANJI zimene simunagwiritse ntchito?

- Panalinsu zifukwa zina zimene zinakupangitsani kuti musankhe kuti musagwiritsire coupon kukagulira zipangizo zotsika mtengo?
- Inuyo, munalibe matha pomwe munkaganiza kuti mupite kapena musapite ku sitolo ndi coupon?
- Mu nyumba mwanu, mumaganiza bwanji mmene mungagwiritsire ntchito coupon ya subsidy?

'Coupon type' code (see B3) Coupon yanji?	Main reason (for not redeeming) Chifukwa chake	Other reason zifukwa zina	Concern for safety? Malingaliro	Decision-making (coupon use) Chiganizo

B12. (If household did not use all of the subsidised inputs on own land) What did you do with the remaining subsidised inputs?

- In your household, how is it decided how subsidised inputs (fertiliser or seed) are to be used?
- What were the reasons why you chose to not use all of the subsidised inputs on your land?

CHICHEWA B12. (If household did not use all of the subsidised inputs on own land)

Munapanga chiyani ndi zipangizo zina zotsika mtengo?

- Mu nyumba mwanu, Munapanga bwani kuti muganize mmene zipangizo zotsika mtengo zingagwiritsidwe ntchito?
- Ndi zifukwa ziti zimene zinakupangitsani kusankha kuti musagwiritse ntchito zipangizo zotsika mtengo pa munda wanu?

B13. Why do you think you did not receive a voucher this year?

- What other reasons do you know of why people did not receive coupons?

CHICHEWA B13. Ndi chifukwa chiyani simunalandire coupon chaka chino?

- Ndi zifukwa zina ziti zimene mumadziwa zimene zinapangitsa anthu kuti asalandire coupon?

B14. I would like you to imagine that it is November and coupons have been given out. You are offered a lump sum of money either for your coupon or for the subsidised fertiliser that you buy. How many Kwacha do you think you would require as a payment in order to part with the coupon or the fertiliser?

- Can you please explain your choice?

CHICHEWA B14. Mungoganizira kuti panopa tili mu November ndipo ma coupon aperekedwa. Mwapatsidwa ndalama zambiri zote mulandire coupon kapena mugulire feteleza otsika mtengo. Mungafune ndalama zingati ngati malipiro kuti mugulitse coupon kapena feteleza?

- Mungandifotokozere kusankha kwanu?

The coupon allocation process

C1. Can you tell me about the procedure that was used in your village in the last agricultural season (from Nov 2012) for deciding who should receive subsidy coupons, starting with:

- How many meetings were held in total?
- What happened at each meeting?
- Who was present at each meeting?
- What was the role of each person?
- Of the people you mentioned were involved, who had the most influence on the process? And after them, who had the second most influence (and so on)?

Mungandiwuzeko za ndondomeko imene anagwiritsa ntchito mu mudzi wa-----mu ulimi wa chaka chatha (Kuyambira mu Nov 2012/2013) pamene amaganiza munthu amene akuyenera kulandira ma coupon, (Kuyambira):

- Anakumana(kukhala ndi ma meeting) kangati akaphatikiza?
- Chinachitika ndi chiyani pa kukumana(meeting) kuli konse?
- Pokumana kunali ndani ndi ndani?
- Ntchito ya munthu wina ali yense inali yotani?
- Pa anthu amene mwatchulawa, kodi inuyo munatengako mbali? Inuyo mukamawona, amene anatenga gawo lalikulu ndi ndani pantchitoyi? Kupatula munthu uyu, winanso ndi ndani amene anatenga gawo lalikulu?

Meeting number (Nambala)	What happened (Chinachitika ndi chiyani?) (add line between meetings)	Person involved (Munthu anabwera anali ndani)	Description of role (Ntchito ya munthuyo inali yotani?)	Influence (ranking)

C2. Did anyone explain to you what the criteria were to determine who should receive a coupon and/or how many coupons they should receive? If so, who explained this and what did they say?

CHICHEWA C2. Kodi munthu wina ali yense anayamba wakufotokozerani choyenera kuganizira posankha amene akuyenera kulandira ma coupon? Ngati zili choncho, fotokozani. Nanga anakufotokozerani nambala ya ma coupon amene akuyenera kulandira? Ngati zili chincho, fotokozani ndipo anati chiyani?

C3. What were the most important things that determined who got a voucher? (list in order of importance)

CHICHEWA C3. Kodi munthu kuti alandire pepala logulira feteleza ndi mbewu(voucher/coupon) amayenera kukhala otani? (list in order of importance).

C4. I understand that in Malawi female headed households tend to be less likely to receive a coupon and are less likely to receive such large quantities of subsidised fertiliser as male headed households, have you seen this happen in (name of village) and if so, why do you think this happens?

CHICHEWA C4. Ndikudziwa kuti kuno ku Malawi manyumba amene wamkulu wapakhomo ali mzimayi, nthawi zambiri samapatsidwa mwayi kulandira ma coupon komanso samalandira zipangizo zotsika mtengo zambiri kuyerekeza ndi manyumba amene wamkulu wa pakhomo ndi mzimbombo. Kodi izi zimachitika m'mudzi muno? Ngati zili chocho, mukuona kuti izi zimachitika chifukwa chiyani?

C5. I understand in some villages that the village head has been known to give coupons to their relatives. Have you heard of this happening in the surrounding villages? (If so, please explain)

- Have you witnessed this happen in (name of village)?
- If it happens, how can this happen when there are supposed to be open meetings to agree on beneficiaries?

CHICHEWA C5. Ndikudziwa kuti mu midzi ina, amfumu a mmudzi amatchuka kupereka ma coupon kwa abale awo. Kodi inu munayamba mwaonapo izi zikuchitika (mdera lino?) Nanga mmudzi mwa_____

- Ndiye ngati izi zimachitika, zimatheka bwanji pomwe pamayenera kukhala msonkhano kugwirizana za anthu amene akuyenera kulandira ma coupon?

C6. In the last agricultural season, was a list of villagers who were going to receive coupons posted somewhere?

- If so, where and what has been the effect of this (if any) compared to earlier years when there was no list?
- One of the reasons for the list was to make sure that people who were allocated coupons ended up getting them. Did this always happen? If not, why not?
- Any other positive / negative effects?

CHICHEWA C6. Mu ulimi wathawu(2012/2013), kodi ndandanda wa anthu a mudzi amene amayenera kulandira ma coupon unamatidwa pena pake kumudzi wa_____?

- Ngati zili choncho, anamata pati? Tikayerekeza ndi kale lija pomwe kunalibe ndandanda wa anthu wolembedwa mukuwona kuti ndandandawu wathandiza chiyani? (Ngatinso siwunathandize, fotokozani.)(effect).
- Chifukwa chimodzi choyikira list chinali kuwonetsetsa kuti anthu amene anayikidwa kuti adzalandira ma coupon alandiradi. Kodi izi zinali chonchi? Ngati sizinali chonchi, chifukwa chiyani?
- Nanga pali zinanso zabwino/zoipa zimene munazona?

C7. Thinking about all previous agricultural seasons, have you ever heard of people buying or selling coupons in the area?

- If yes, please can you tell me about that?
- Have you heard or seen it happen in this village?
- Who is it that typically sells coupons?
- Why do you think people choose to sell coupons?
- How common do you think it is? (1=very common, 2=fairly common, 3=fairly uncommon, 4=never happens)
- How has this changed in recent years (if at all)?

CHICHEWA C7. Tikaganiza za ulimi wa mbuyomu, kodi munamvako kuti anthu akugula ndi kugulitsa ma coupon ku dera lino

- Ngati eya, Chonde ndiwuzeniko za izi?
- Nanga munayamba mwamvako kapena mwazonako zikuchitika mmudzi muno?
- Ndi ndani kwenikweni amene amagulitsa ma coupon?
- Ndi chifukwa chiyani anthu amasankha kugulitsa ma coupon?
- Kodi zogulitsa ma coupon ndizochulukira bwanji?
(1=Ndi zochulukira kwambiri, 2=Ndizochulukirako, 3=ndizosachulukira,)
- Kodi zogulitsa ma coupon zasintha bwanji mu zaka zamasiku ano? (Ngati zasintha)

C8. Thinking about all previous agricultural seasons, have you ever heard of people selling *subsidised inputs* (or buying them – in addition to any inputs they may have bought using their own coupons) in the area?

- If yes, please can you tell me about that?
- Have you heard or seen it happen in this village?
- Who is it that typically sells subsidised inputs?
- Why do you think people choose to sell inputs?
- How common do you think it is? (1=very common, 2=fairly common, 3=fairly uncommon, 4=never happens)
- Have you ever sold subsidised inputs?
- How has this changed in recent years (if at all)?

CHICHEWA C8. Tikaganiza za ulimi wapitawo, mwamvapo za anthu amene amagulitsa zipangizo za ulimi zotsika mtengo mdera lino? (kapena mwanvapo za munthu wina aliyense akugula zipangizo zotsika mtengo – kuphatikizira zipangizo zawo zimene anagula kale kugwiritsa ntchito ma coupon?)

- Ngati eya, Chonde tandiuzani za izi.
- Nanga munamvapo kapena munawonako izi zikuchitika mmudzi muno?
- Ndi ndani kweni kweni amene amagulitsa zipangizo za ulimi zotsika mtengo?
- Nanga ndi chifukwa chiyani anthu amasankha kugulitsa zipangizo zaulimizi?
- Kodi zogulitsa zipangizo zotsika mtengozi, ndizochulukira bwani? (1=Ndi zochulukira kwambiri, 2=Ndizochulukirako, 3=ndizosachulukira, 4=Never happens)

C9. I understand that sharing of coupons can often take place in villages. Has this happened in this village?

- If so, who decides when someone shares their coupons with others?

CHICHEWA C9. Ndikudziwa kuti nthawi zambiri anthu amagawana coupon m'mudzi. Izi zimachitika mudzi muno?

- Kodi amene amaganiza kuti uyu agayire mzake coupon ndi ndani?

C10. I want to understand how similar people in this village are in terms of their wealth or income. Which of the following would you say best describes the village (**show diagram**):

1= Everyone is on the same level in terms of household assets, livestock or income

2= Most people are on the same level but one or two are at a different level

3= Many people are on the same level but a number of people are on a different level

4= People are on quite different levels

CHICHEWA C10. Ndikufuna kumvetsetsa mmene midzi imafananilana kutengera ndalama zimene amazipeza kapena kapezedwe. Inuyo mungati ndi chithunzi chiti chimene chikunena zowona zeni zeni za mudzi.

1. Aliyense ndiwofanana mu mapezedwe kutengera katundu wa nyumba amene ali naye ndi ziweto kapena kapezedwe.
2. Anthu ambiri ndi wofanana kapezedwe koma pali modzi kapena awiri mene ali wosiyana mu kapezedwe
3. Anthu ambiri amapeza mofanana, koma pali anthu angapo amene amapeza mosiyana.
4. Anthu ndiwosiyana kwambiri kapezedwe

C11. I also want to understand how trusting and close together people feel with one another in the village. Which of the following would you say best describes the village:

1 = All people are very trusting of one another and everyone feels close ties to each other

2 = People mostly trust one another and most people feel close ties to each other

3 = People sometimes trust one another and some people have close ties between each other

4 = People do not trust one another very much and there are not many close ties between people

CHICHEWA C11. Komanso ndikufuna kumvetsetsa mmene anthu a mdera lino amakhulupilirana ndi mmene anthu amakahalira pafupi limodzi mudzi muno? Pa zinthu izi zomwe titakutchulireni apa, zimene zikunena zowona za mudzi uno ndi ziti?

1. Anthu onse mudzi muno amakhulupilirana kwambiri ndipo aliyense amakhala ngati a pa chibale
2. Anthu amudzi nthawi zambiri amakhulupilirana wina ndi mzake ndipo amakhala ngati pa chibale
3. Nthawi zina anthu amakhulupilirana ndipo anthu ena amakhala ngati pa chibale
4. Anthu samakhulupilirana wina ndi mzake ndipo anthu samakhala ngati pa chibale.

Benefits and problems with the FISP

C12. Thinking specifically about your own household and this village, have you seen any benefits from the FISP? If so, please describe them.

CHICHEWA C12. Kuganiza kweni kweni za nyumba yanu ndi mudzi uno, mwaonapo ubwino wina uli wonse (wa subsidy?) pa pulogalamu yolandira zipangizo za ulimi zotsika mtengo? Ngati zili choncho, fotokozani.

C13. Thinking again about your own household and this village, have you seen any negative effects of the FISP?

CHICHEWA C13. Tiganizenso za nyumba yanu ndi za mudzi uno, kodi mwaonanso zoipa zina zili zonse (za subsidy?)pa pulogalamu yolandira zipangizo za ulimi zotsika mtengo?

C14. Is there anything else at all that you would like to tell me about the FISP and how it works in this village?

CHICHEWA C14. Palinso china chilli chonse chimene mungafune kundiwuza za pulogalamu ya(subsidy)zipangizo zotsika mtengo ndi mmene imagwilira ntchito mmudzi muno?

**Thank the participant
Zikomo kwambiri**

Appendix 14: Sample districts in 2008 TNVS household survey

Zone	Region	District
Central	Manyara	Simanjiro
	Dodoma	Bahi
	Singida	Singida Rural
Coast	Coast	Kisarawe
		Rufiji
	Dar es Salaam	Kinondoni
Lake	Mara	Rorya
	Kagera	Chato
		Karagwe
	Mwanza	Sengerema
Northern	Arusha	Arusha Rural
	Kilimanjaro	Rombo
		Moshi Rural
	Tanga	Muheza
Southern	Mtwara	Mtwara Urban
	Lindi	Nachingwea
	Ruvuma	Namtumbo
Southern Highlands	Mbeya	Mbeya Urban
	Rukwa	Sumbawanga Rural
	Iringa	Makete
		Iringa Rural
Western Lake	Shinyanga	Bariadi
		Shinyanga Urban
	Kigoma	Kigoma Urban

Source: 2008 TNVS Monitoring and Evaluation report.

Appendix 15: Summary of variables used for Multiple Correspondence Analysis

Category	Variable	Dimension 1 score	Mean	Standard deviation
Toilet	No toilet	-1.027	0.11	0.32
	Pit latrine	-0.206	0.83	0.37
Water	Flush toilet	5.128	0.06	0.23
	Rents the house	2.559	0.09	0.29
	Piped / external water	2.257	0.16	0.37
	Public tap	0.555	0.24	0.43
	Well / hole / spring	-0.903	0.42	0.49
Fuel	Surface water	-0.817	0.17	0.37
	Uses charcoal	3.647	0.15	0.36
	Uses firewood / dung	-0.710	0.84	0.37
Housing	Rudimentary or finished floor	2.486	0.17	0.37
	Iron sheet or tiled roof	0.817	0.58	0.49
	Has electricity	4.329	0.12	0.32
Assets	Owens a fridge	5.913	0.05	0.21
	Owens a TV	4.907	0.09	0.28
	Owens a radio	0.361	0.67	0.47
	Owens a bicycle	-0.111	0.45	0.50
	Owens a mobile	1.524	0.36	0.48
Livestock	Owens ducks or chickens	-0.431	0.62	0.49
	Owens other animals (e.g. goats, sheep or cattle)	-0.519	0.40	0.49

Source: Author's calculations. First dimension accounts for 75.68% of inertia.

Appendix 16: IV estimation using LIML estimator (heardIV as instrument)

		Number of obs =	6918	
		F(29, 6888) =	13.23	
		Prob > F =	0.0000	
Total (centered) SS	=	2897.893611	Centered R2 =	0.1302
Total (uncentered) SS	=	3224	Uncentered R2 =	0.2182
Residual SS	=	2520.667097	Root MSE =	.6036

unsub_purch_12m	Robust		z	P> z	[95% Conf. Interval]	
	Coef.	Std. Err.				
tnvs_13m_plus	-.0631798	.3541928	-0.18	0.858	-.7573849	.6310254
unsub_purch_13to36	.031845	.0898168	0.35	0.723	-.1441926	.2078827
tnvs_purch_12m	-.0268482	.0348513	-0.77	0.441	-.0951554	.041459
free_net_12m	-.009712	.0521075	-0.19	0.852	-.111841	.0924169
freenet_13m_plus	.0107219	.092854	0.12	0.908	-.1712687	.1927124
totalnets12m	-.092331	.0835859	-1.10	0.269	-.2561564	.0714944
distmed_4x7	.0001211	.0000304	3.98	0.000	.0000614	.0001807
quintile5	.2805945	.0368065	7.62	0.000	.2084551	.3527339
quintile4	.0268915	.0196071	1.37	0.170	-.0115378	.0653208
quintile3	-.0068169	.0185692	-0.37	0.714	-.0432119	.0295781
quintile2	-.020634	.0161602	-1.28	0.202	-.0523074	.0110394
rural	-.1757781	.0539137	-3.26	0.001	-.281447	-.0701092
semiurban	-.1159022	.0553529	-2.09	0.036	-.2243918	-.0074125
hheduc17	-.0117998	.0182428	-0.65	0.518	-.0475551	.0239555
hheduc8plus	.0729314	.0405792	1.80	0.072	-.0066024	.1524653
heardPWV	.0800746	.0252333	3.17	0.002	.0306182	.129531
femalehead	-.0058298	.0186819	-0.31	0.755	-.0424456	.030786
headage2229	.0282946	.0339199	0.83	0.404	-.0381872	.0947764
headage3049	.0246158	.0329648	0.75	0.455	-.0399941	.0892258
headage50plus	.0301289	.0435185	0.69	0.489	-.0551658	.1154237
profservbus	.1329138	.033094	4.02	0.000	.0680507	.1977769
hh_size	.0440208	.0070258	6.27	0.000	.0302505	.0577911
under5	-.020072	.0198804	-1.01	0.313	-.0590368	.0188928
over50	-.0159624	.0236314	-0.68	0.499	-.0622792	.0303543
women1549	.0301167	.0171489	1.76	0.079	-.0034945	.063728
currpreg	.0426165	.0293855	1.45	0.147	-.014978	.100211
prevpreg12m	-.0336105	.0234126	-1.44	0.151	-.0794985	.0122774
retaildensity	.0045989	.0137389	0.33	0.738	-.0223288	.0315266
mprev	.0038721	.0005971	6.49	0.000	.0027019	.0050423
_cons	-.384165	.143198	-2.68	0.007	-.6648279	-.103502

Underidentification test (Kleibergen-Paap rk LM statistic): 30.326
Chi-sq(1) P-val = 0.0000

Weak identification test (Cragg-Donald Wald F statistic): 33.330
(Kleibergen-Paap rk Wald F statistic): 30.350
Stock-Yogo weak ID test critical values: 10% maximal LIML size 16.38
15% maximal LIML size 8.96
20% maximal LIML size 6.66
25% maximal LIML size 5.53

Source: Stock-Yogo (2005). Reproduced by permission.
NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.

Hansen J statistic (overidentification test of all instruments): 0.000
(equation exactly identified)

-endog- option:
Endogeneity test of endogenous regressors: 0.003
Chi-sq(1) P-val = 0.9600

Regressors tested: tnvs_13m_plus

Source: Author's analysis.

Appendix 17: IV estimation using LIML estimator (gotvouch as instrument)

		Number of obs =	6918
		F(30, 6887) =	12.82
		Prob > F =	0.0000
Total (centered) SS =	2897.893611	Centered R2 =	0.1300
Total (uncentered) SS =	3224	Uncentered R2 =	0.2180
Residual SS =	2521.105313	Root MSE =	.6037

unsub_purch_12m	Robust		z	P> z	[95% Conf. Interval]	
	Coef.	Std. Err.				
tnvs_13m_plus	-.0147605	.0769314	-0.19	0.848	-.1655433	.1360224
unsub_purch_13to36	.0437435	.02588	1.69	0.091	-.0069804	.0944675
tnvs_purch_12m	-.0233435	.0229182	-1.02	0.308	-.0682624	.0215754
free_net_12m	-.0054982	.0418239	-0.13	0.895	-.0874717	.0764752
freenet_13m_plus	.023058	.0267815	0.86	0.389	-.0294328	.0755488
totalnets12m	-.1036495	.0217579	-4.76	0.000	-.1462942	-.0610048
distmed_4x7	.000119	.0000249	4.78	0.000	.0000702	.0001677
quintile5	.2823237	.0360066	7.84	0.000	.2117521	.3528952
quintile4	.0273498	.0191612	1.43	0.153	-.0102054	.064905
quintile3	-.0057632	.0167085	-0.34	0.730	-.0385113	.0269849
quintile2	-.020479	.0161501	-1.27	0.205	-.0521327	.0111746
rural	-.1776178	.0515249	-3.45	0.001	-.2786047	-.0766309
semiurban	-.1172375	.0537339	-2.18	0.029	-.2225541	-.0119209
hheduc17	-.0124987	.0175671	-0.71	0.477	-.0469296	.0219322
hheduc8plus	.0745624	.0388401	1.92	0.055	-.0015628	.1506877
heardPWV	.0786384	.0189861	4.14	0.000	.0414264	.1158504
heardIV	-.0024915	.018582	-0.13	0.893	-.0389116	.0339285
femalehead	-.0049271	.0172943	-0.28	0.776	-.0388233	.0289691
headage2229	.0271895	.0327771	0.83	0.407	-.0370524	.0914313
headage3049	.023086	.0312437	0.74	0.460	-.0381505	.0843224
headage50plus	.0289716	.0423258	0.68	0.494	-.0539855	.1119287
profservbus	.1336483	.0330282	4.05	0.000	.0689142	.1983824
hh_size	.0444513	.0064937	6.85	0.000	.031724	.0571786
under5	-.0217333	.0157058	-1.38	0.166	-.0525161	.0090494
over50	-.0150741	.0229497	-0.66	0.511	-.0600548	.0299066
women1549	.0306707	.0171998	1.78	0.075	-.0030403	.0643817
currpreg	.0430235	.029431	1.46	0.144	-.0146603	.1007073
prevpreg12m	-.035952	.0155105	-2.32	0.020	-.0663519	-.005552
retaildensity	.0039517	.0127084	0.31	0.756	-.0209562	.0288596
mprev	.0039039	.0005863	6.66	0.000	.0027547	.0050531
_cons	-.3745232	.1149629	-3.26	0.001	-.5998462	-.1492001

Underidentification test (Kleibergen-Paap rk LM statistic): 393.395
Chi-sq(1) P-val = 0.0000

Weak identification test (Cragg-Donald Wald F statistic): 711.321
(Kleibergen-Paap rk Wald F statistic): 428.795
Stock-Yogo weak ID test critical values: 10% maximal LIML size 16.38
15% maximal LIML size 8.96
20% maximal LIML size 6.66
25% maximal LIML size 5.53

Source: Stock-Yogo (2005). Reproduced by permission.

NB: Critical values are for Cragg-Donald F statistic and i.i.d. errors.

Hansen J statistic (overidentification test of all instruments): 0.000
(equation exactly identified)

-endog- option:

Endogeneity test of endogenous regressors: 0.166
Chi-sq(1) P-val = 0.6840

Regressors tested: tnvs_13m_plus

Source: Author's analysis.

Appendix 18: Marginal effects from second stage of control function approach using Poisson model

Poisson regression

Number of obs = 6918
Wald chi2(31) = 959.25
Prob > chi2 = 0.0000
Pseudo R2 = 0.1728

Log pseudolikelihood = -3528.1208

	Delta-method					[95% Conf. Interval]	
	dy/dx	Std. Err.	z	P> z			
tnvs_13m_plus	-.0934565	.0804964	-1.16	0.246	-.2512266	.0643136	
tnvs_purch_12m	-.0493018	.0269162	-1.83	0.067	-.1020566	.0034531	
tnvs12_13plus_bin	.1997548	.0663367	3.01	0.003	.0697372	.3297724	
quintile5	.2266034	.0288329	7.86	0.000	.170092	.2831148	
quintile4	.0563547	.0272442	2.07	0.039	.0029572	.1097523	
quintile3	-.004318	.0280698	-0.15	0.878	-.0593338	.0506977	
quintile2	-.029222	.0288663	-1.01	0.311	-.085799	.0273549	
rural	-.0917473	.0254175	-3.61	0.000	-.1415646	-.04193	
semiurban	-.0239373	.0224383	-1.07	0.286	-.0679155	.020041	
unsub_purch_13to36	.0431927	.0234086	1.85	0.065	-.0026874	.0890728	
free_net_12m	-.0142942	.0434701	-0.33	0.742	-.0994941	.0709057	
freenet_13m_plus	-.0025209	.0361337	-0.07	0.944	-.0733416	.0682998	
totalnets12m	-.0893524	.0214147	-4.17	0.000	-.1313245	-.0473803	
distmed_4x7	.0001599	.0000318	5.03	0.000	.0000976	.0002223	
hheduc17	.005748	.0232088	0.25	0.804	-.0397404	.0512364	
hheduc8plus	.0575278	.0284805	2.02	0.043	.001707	.1133485	
heardPWV	.1235536	.0256592	4.82	0.000	.0732626	.1738447	
femalehead	-.0099934	.0188265	-0.53	0.596	-.0468927	.0269058	
headage2229	.0468233	.0409385	1.14	0.253	-.0334147	.1270613	
headage3049	.045015	.0378264	1.19	0.234	-.0291233	.1191533	
headage50plus	.0343211	.0464373	0.74	0.460	-.0566944	.1253365	
profservbus	.058882	.0181542	3.24	0.001	.0233005	.0944635	
hh_size	.0392716	.0046464	8.45	0.000	.0301649	.0483783	
under5	-.013956	.0120204	-1.16	0.246	-.0375156	.0096036	
over50	-.0064856	.0196402	-0.33	0.741	-.0449798	.0320085	
women1549	.0073785	.0103572	0.71	0.476	-.0129212	.0276781	
currpreg	.0424935	.0233595	1.82	0.069	-.0032902	.0882772	
prevpreg12m	-.0269397	.0136865	-1.97	0.049	-.0537648	-.0001146	
retaildensity	-.0035928	.0130564	-0.28	0.783	-.0291829	.0219973	
mprev	.0039517	.0005606	7.05	0.000	.0028529	.0050504	
lpuhat	-.0392846	.0815213	-0.48	0.630	-.1990633	.1204942	

Source: Author's analysis.

Appendix 20: Double hurdle model (Hurdle one: Probit with tnvs_13m_plus as dependent variable)

Log pseudolikelihood = -3647.0715
 Number of obs = 6918
 Wald chi2(31) = 655.47
 Prob > chi2 = 0.0000

	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
Tier1						
tnvs_13m_plus	-.3812224	.0778231	-4.90	0.000	-.5337527	-.228692
tnvs_purch_12m	-.1554962	.0762999	-2.04	0.042	-.3050412	-.0059512
tnvs12_13plus	.4765416	.1415839	3.37	0.001	.1990423	.7540409
quintile5	.5638293	.0761324	7.41	0.000	.4146124	.7130461
quintile4	.1272009	.0682227	1.86	0.062	-.0065131	.2609149
quintile3	-.0259085	.0683104	-0.38	0.704	-.1597944	.1079774
quintile2	-.0523003	.0693987	-0.75	0.451	-.1883192	.0837186
rural	-.3124443	.0784846	-3.98	0.000	-.4662712	-.1586174
semiurban	-.2014561	.072814	-2.77	0.006	-.344169	-.0587432
unsub_purch_13to36	.0957693	.0442966	2.16	0.031	.0089496	.182589
free_net_12m	-.0890508	.1027803	-0.87	0.386	-.2904964	.1123949
free_net_24m	.0933067	.1483266	0.63	0.529	-.1974081	.3840215
free_net_36m	-.1871621	.1914377	-0.98	0.328	-.562373	.1880488
free_net_48m	-.08215	.115829	-0.71	0.478	-.3091706	.1448707
totalnets12m	-.1417406	.0318035	-4.46	0.000	-.2040743	-.079407
distmed_4x7	.0002764	.0000777	3.56	0.000	.0001241	.0004286
hheduc17	.0729465	.0567393	1.29	0.199	-.0382604	.1841535
hheduc8plus	.1982646	.0801012	2.48	0.013	.0412692	.3552599
heardPWV	.3731453	.0577507	6.46	0.000	.2599561	.4863346
femalehead	-.0378344	.0531135	-0.71	0.476	-.141935	.0662662
headage2229	.1661106	.1130188	1.47	0.142	-.0554022	.3876234
headage3049	.1587124	.1045164	1.52	0.129	-.0461361	.3635608
headage50plus	.0199345	.1244391	0.16	0.873	-.2239617	.2638307
profservbus	.2229716	.0573857	3.89	0.000	.1104977	.3354456
hh_size	.0629615	.0132671	4.75	0.000	.0369585	.0889645
under5	.005042	.0359171	0.14	0.888	-.0653542	.0754382
over50	-.020923	.052173	-0.40	0.688	-.1231802	.0813341
women1549	.0302711	.0326829	0.93	0.354	-.0337863	.0943285
currpreg	.0550863	.0642605	0.86	0.391	-.0708621	.1810346
prevpreg12m	-.0726808	.0346207	-2.10	0.036	-.1405362	-.0048255
mprev	.011282	.0015074	7.48	0.000	.0083275	.0142365
_cons	-2.751879	.3179784	-8.65	0.000	-3.375105	-2.128653

Source: Author's analysis.

Appendix 21: Double hurdle model (Hurdle two: Truncated normal with unsub_purch_12m as dependent variable)

Tier2							
tnvs_13m_plus	-.1555996	.1352918	-1.15	0.250	-.4207666	.1095675	
tnvs_purch_12m	-.3644227	.1320561	-2.76	0.006	-.6232478	-.1055975	
tnvs12_13plus_bin	.7475503	.4216542	1.77	0.076	-.0788768	1.573977	
quintile5	.3623789	.1713123	2.12	0.034	.026613	.6981447	
quintile4	.0869563	.1317676	0.66	0.509	-.1713034	.345216	
quintile3	-.0492372	.1383906	-0.36	0.722	-.3204777	.2220034	
quintile2	-.186729	.1361751	-1.37	0.170	-.4536272	.0801693	
rural	-.1615014	.1476805	-1.09	0.274	-.4509499	.127947	
semiurban	.0865853	.1408481	0.61	0.539	-.1894718	.3626425	
unsub_purch_13to36	.0689226	.0912637	0.76	0.450	-.1099511	.2477962	
free_net_12m	.0746647	.2191065	0.34	0.733	-.3547761	.5041055	
free_net_24m	.2834	.1997399	1.42	0.156	-.108083	.674883	
free_net_36m	.5237421	.4199188	1.25	0.212	-.2992836	1.346768	
free_net_48m	.0169521	.127586	0.13	0.894	-.233112	.2670161	
totalnets12m	-.4197251	.0894661	-4.69	0.000	-.5950755	-.2443748	
distmed_4x7	.0004014	.0001484	2.70	0.007	.0001105	.0006923	
hheduc17	-.0144205	.1421647	-0.10	0.919	-.2930583	.2642173	
hheduc8plus	.2134184	.1794722	1.19	0.234	-.1383406	.5651774	
heardPWV	-.0511698	.145715	-0.35	0.725	-.336766	.2344264	
femalehead	-.0139936	.1000243	-0.14	0.889	-.2100377	.1820504	
headage2229	-.2929488	.1882816	-1.56	0.120	-.661974	.0760765	
headage3049	-.0994188	.1766304	-0.56	0.574	-.445608	.2467703	
headage50plus	.2688774	.2468974	1.09	0.276	-.2150327	.7527874	
profservbus	.0874447	.1168942	0.75	0.454	-.1416638	.3165532	
hh_size	.1764047	.0315351	5.59	0.000	.114597	.2382124	
under5	-.1203231	.0730672	-1.65	0.100	-.2635322	.022886	
over50	-.0191076	.1218427	-0.16	0.875	-.2579149	.2196997	
women1549	.1197221	.0761622	1.57	0.116	-.029553	.2689972	
currpreg	.2591023	.1472094	1.76	0.078	-.0294227	.5476274	
prevpreg12m	-.0514459	.0729433	-0.71	0.481	-.1944122	.0915205	
mprev	.0054166	.0034162	1.59	0.113	-.001279	.0121122	
retaildensity	-.0755879	.0645394	-1.17	0.242	-.2020828	.0509069	
_cons	-.8647546	.7115987	-1.22	0.224	-2.259463	.5299533	

Source: Author's analysis. Note: Coefficient on *tnvs_13m_plus* cannot be directly interpreted from the output but must be estimated using postestimation analysis following Burke (2009).

Appendix 22: OLS estimation

Linear regression

Number of obs = 6918
 F(29, 6888) = 14.18
 Prob > F = 0.0000
 R-squared = 0.1302
 Root MSE = .60491

unsub_purch_12m	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
tnvs_13m_plus	-.0454841	.0174246	-2.61	0.009	-.0796416	-.0113265
tnvs_purch_12m	-.0256582	.0229027	-1.12	0.263	-.0705545	.0192382
quintile_mca						
2	-.0205834	.0161787	-1.27	0.203	-.0522986	.0111317
3	-.0064383	.0166356	-0.39	0.699	-.0390491	.0261726
4	.0270751	.0191698	1.41	0.158	-.0105036	.0646538
5	.2812259	.0359085	7.83	0.000	.210834	.3516177
semiurban	-.1164698	.0535509	-2.17	0.030	-.2214461	-.0114935
rural	-.1765037	.0512894	-3.44	0.001	-.2770467	-.0759607
unsub_purch_13to36	.0362177	.0170236	2.13	0.033	.0028461	.0695892
free_net_12m	-.0081627	.0417554	-0.20	0.845	-.0900161	.0736907
freenet_13m_plus	.0152693	.0187562	0.81	0.416	-.0214986	.0520372
totalnets12m	-.0965045	.0123305	-7.83	0.000	-.1206762	-.0723329
distmed_4x7	.0001202	.0000246	4.89	0.000	.0000721	.0001684
1.hheduc17	-.0120707	.0173959	-0.69	0.488	-.046172	.0220306
1.hheduc8plus	.0735067	.0389497	1.89	0.059	-.0028467	.1498601
1.heardPWV	.0791683	.0170284	4.65	0.000	.0457874	.1125492
1.femalehead	-.0054949	.0173447	-0.32	0.751	-.0394959	.028506
1.headage2229	.027919	.0329662	0.85	0.397	-.036705	.092543
1.headage3049	.024088	.031375	0.77	0.443	-.0374167	.0855926
1.headage50plus	.0297297	.0425277	0.70	0.485	-.0536378	.1130972
1.profservbus	.1331302	.033145	4.02	0.000	.0681557	.1981047
hh_size	.0441774	.0064055	6.90	0.000	.0316206	.0567341
under5	-.0206782	.0156129	-1.32	0.185	-.0512843	.0099279
over50	-.0156235	.0229921	-0.68	0.497	-.060695	.029448
women1549	.0303158	.0172185	1.76	0.078	-.0034377	.0640693
currpreg	.042774	.0295649	1.45	0.148	-.0151822	.1007303
prevpreg12m	-.0345026	.0149797	-2.30	0.021	-.0638674	-.0051378
retaildensity	.004343	.012727	0.34	0.733	-.0206059	.0292919
mprev	.0038802	.0005808	6.68	0.000	.0027417	.0050188
_cons	-.3803496	.1130351	-3.36	0.001	-.6019332	-.158766

Source: Author's analysis.