Targeting of Beneficiaries in Chemical Fertilizer Subsidy Programs: State of Knowledge and Evidence Gaps*

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Abstract

Low and middle income countries have been facing mounting pressure from lenders and donors to eliminate or reform fertilizer subsidy programs, which can have distortionary market effects and negative environmental externalities. However, there is little systematic work understanding who these programs currently benefit both in theory and in practice, and hence who may be affected by policy reform. In this paper, we identify low and middle countries with active fertilizer subsidy programs, and characterize the targeting regime of each program based on both explicit and implicit criteria determining eligibility. Then in a selection of case studies, we explore which individuals are receiving subsidy benefits in practice. We find that while many fertilizer subsidy programs are meant to be universal, there are are additional implicit targeting criteria and/or informal targeting induced by supply shortfalls in many countries. Further, we find evidence that regardless of targeting regime, fertilizer subsidies are generally progressive, though this seems to be driven by the fact that the poor are often concentrated in the agricultural sector.

1 Introduction

Providing price subsidies to farmers for the purchase chemical fertilizers is a widespread agricultural policy tool, particularly in Low-Income Countries (LICs) and Lower-Middle-Income Countries (LMICs) [Jayne and Rashid, 2013]. Policymakers typically implement fertilizer subsidy programs in order to satisfy multiple policy objectives, such as improving the incomes of the farmers, boosting domestic food production, ensuring national food security, or keeping consumer prices stable [Wanzala-Mlobela et al., 2013, Putri et al., 2023]. Yet these input subsidies are distortionary by nature, aiming to increase the use of chemical fertilizer by reducing it's price to below market price, and sometimes even to promote the production of specific crops, which can in turn distort crop prices Hill and Resnick [2025]. As such, fertilizer subsidies can potentially lead to the overuse of fertilizer [Kurdi et al., 2020] as well as artificially increase the competitiveness of domestic farmers on the global stage, which may violate international trade agreements [Amaglobeli et al., 2024]. Crucially, the environmental and health costs of over-application of inorganic fertilizers can be significant, leading to increased water pollution [Srivastav et al., 2024], increased greenhouse gas emissions [Xu et al.,

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2023], degradation of soil health [Shukla et al., 2022] and even increased infant mortality rates [Venkateswaran et al., 2025]. Given these potential unintended negative consequences, major development institutions such as the World Bank and International Monetary Fund have increasingly been calling for governments to reform large input subsidy programs, such that they are much smaller and more carefully targeted, or replace fertilizer subsidies with less distortionary alternative policies [Damania et al., 2023, Amaglobeli et al., 2024] that will achieve similar policy objectives around promoting agriculture-led growth and improving farmers' livelihoods.

Policy reform, however, is an inherently political process, and any policy changes have the potential to generate "winners" and "losers," who will vary based on the context and targeting rules of the policy. Developing feasible policy alternatives to fertilizer subsidies must be grounded in a careful understanding of who currently benefits from input subsidy programs, both in theory and in practice. This is especially true of fertilizer subsidies, which sometimes serve strategic functions for politicians themselves, including generating visible and tangible evidence of government-service provision [Mani and Mukand, 2007] and reinforcing clientelistic relationships [Mason et al., 2017]. Yet despite the ubiquity of fertilizer subsidy programs, there is little systematic work comparing targeting regimes and beneficiaries of across countries and programs, making it challenging to develop generalizable suggestions about fertilizer subsidy policy reform. Critically, much of our current knowledge surrounding the targeting of fertilizer subsidies comes from studies of a few relatively well-documented, explicitly welfare-targeted programs, including Malawi's Farm Input Subsidy Program [Dorward and Chirwa, 2013, Holden and Lunduka, 2013, Kilic et al., 2015, Basurto et al., 2020], Ghana's Planting for Jobs Program and its predecessors [Houssou et al., 2019, Tetteh et al., 2025, Banful, 2011], Zambia's Farmer Input Subsidy Program [Mason et al., 2013, 2017], and Tanzania's National Agricultural Input Voucher Scheme [Pan and Christiaensen, 2012, Giné et al., 2022]. Yet these programs are certainly not representative of the total population of fertilizer subsidies programs that exist all over the globe, many of which do not have explicitly stated targeting criteria, or are even purportedly "universal."

This paper seeks to fill this critical gap by systematically characterizing the targeting features of the landscape of fertilizer subsidy policies. We begin by generating a list of all (to our knowledge) continuously active, national government inorganic fertilizer subsidy programs in LICs and LMICs in 2025, using a comprehensive multilingual search of academic literature and news articles. We then explore program features which induce either explicit or implicit targeting of beneficiaries, and identify the features present in each program. Explicit features refer to eligibility criteria set forth in program which is intended to select a specific pool of beneficiaries, whereas implicit features refer to other program elements that are likely not intended to affect beneficiary pool composition, but likely end up doing so in practice. Such implicit features may include administrative hurdles imposed by program registration or infrastructure needed for subsidy receipt (like a mobile phone or bank account.) We then compare this set of features between various subsidy programs, and create a typology that broadly describes and categorizes the universe of targeting regimes. Following this, where possible, we use publicly available household survey data to analyze the targeting outcomes of programs under different regimes. Specifically, we compare households with subsidy beneficiaries to those without beneficiaries in terms of per capita income and other demographic characteristics, such as household head age and gender. This allows us to understand whether more explicitly targeted regimes lead to more progressive targeting in practice.

Our search identified 39 national fertilizer subsidy programs located in 31 countries. We then sort programs into four overarching types differentiated by the degree of targeting imposed, and then further between sub-types that characterize additional details of the beneficiary selection process. We then are able

to locate household survey data and examine targeting outcomes for 11 country case studies, which span the four regime type categories. This procedure yields various insights. First, while many fertilizer programs are purportedly "universal," most are not truly universal in practice, as they impose implicit criteria that may induces self-targeting. We only identify seven programs that are "truly" universal to the best of our knowledge, in the sense that there are no further administrative hurdles to becoming a beneficiary beyond potentially presenting identification at the time of purchase, and no additional eligibility criteria. Instead, we identify sixteen programs in which additional registration hurdles and/or infrastructure requirements limit the set of beneficiaries in practice, and six programs where ad hoc, informal targeting criteria are regularly used to determine beneficiaries, in the face of frequent supply shortfalls. The remaining 10 programs we identify are formally targeted, using explicit criteria. Second, among programs that are formally targeted, common explicit criteria relate both to production scale (targeting farmers either based on land holdings or past production amounts) and to farmers' welfare. Third, we don't observe a clear association between targeting regime choice and a country's income level or share of the population that is rural, nor with whether the program seems to have a social protection objective. If anything, geographical region is a clearer predictor of targeting regime choice, with universal programs concentrated in South Asia, and informally targeted programs concentrated in sub-Saharan Africa. Finally, though there are potential data issues that suggest we should interpret these results cautiously, household survey data suggests that fertilizer subsidy programs tend to generally be somewhat progressive, regardless of the targeting regime. However, this seems to be driven by the the fact that poor individuals are concentrated in the agricultural sector; if we restrict our focus to rural areas, the progressivity of this policy is much less pronounced. Interestingly, we observe that the choice of targeting regime does not seem to be clearly associated with degree of policy progressivity. This empirical observation may be explained by anecdotal evidence from expert consultations, which suggests a significant divergence between how programs are designed on paper and how they function in the field.

The rest of this paper is structured as follows. Section 2 provides a brief additional background on fertilizer subsidy programs as a policy instrument. Section 3 details the methods used to identify and characterize subsidy programs, and presents the typology developed. Section 4 presents results of the classification exercise, discussing trends in targeting features across programs. Section 5 presents country case studies which compare fertilizer beneficiaries across contexts. Section 6 concludes.

2 Background

Many LICs and LMICs have had subsidies for chemical fertilizers at some point in their history. These policies historically became popular during the period of the Green Revolution in the 1960s and 1970s, as governments sought to maximize the gains stemming from new, highly fertilizer-responsive improved seed varieties [Holden, 2018]. The rationale was that fertilizer is relatively expensive, and small-scale farmers who were experimenting with new, unfamiliar varieties may be reluctant to take the risk of purchasing fertilizer as well. As such, fertilizer subsidies, which were nearly universal, were intended to be a temporary policy instrument that would reduce farmers' learning costs [Dorward, 2009]. Once this learning was accomplished and farmers formed their own demand for fertilizer, subsidies could theoretically be removed. However, large-scale subsidy programs persisted into the 1980s and even 1990s, until they were scaled down as part of structural adjustment reforms imposed by development lenders [Holden, 2018]. Ultimately, this period of subsidies was widely seen as ineffective by economists, as these programs captured large shares of government resources, and political issues meant that benefits accrued to larger, wealthier farmers [Lele, 1990]. At the

same time, the significant role of state-owned enterprises in procuring and distributing subsidized fertilizer crowded out potential private sector development [Sahn, 1992]. Moreover, while fertilizer subsidies may have increased fertilizer use over the long-run in some regions, subsidy policies in regions like sub-Saharan Africa ultimately failed to spur sustained fertilizer adoption [Jayne and Rashid, 2013].

However, new iterations of fertilizer subsidy programs have continued to reemerge in the face of crises, especially those that have increased global fertilizer prices. The first major instance of this trend was in the early to mid 2000s in response to the global food price crisis, with Malawi instituting a new explicitly targeted program in 2005, and various other countries following suit [Jayne and Rashid, 2013]. In order to respond to some of the critiques surrounding earlier subsidy programs, many current program iterations have attempted to decrease leakage through "smarter," more purposeful targeting using better beneficiary tracking systems, and have attempted to integrate the private sector into the distribution chain [Dorward et al., 2008, Morris, 2007]. However, more recently, we have seen both explicitly targeted and universal fertilizer subsidies re-emerge in response to the COVID-19 pandemic, and to price shocks spurred by the war in Ukraine [Ayalew et al., 2025, Nhlengethwa et al., 2023].

Whether smarter targeting in some programs has lead to a favorable change in the beneficiary pool is unclear. Previous evidence from programs such as Malawi's Farmer Input Subsidy Program, Ghana's Farmer Input Subsidy Program, and Zambia's Farmer Input Subsidy Program has suggested that targeted programs still end up reaching wealthier farmers with greater land holdings in practice (see Jayne et al. [2018] for a review). Yet targeted subsidy programs have been rapidly reforming in the last five to ten years, and it is possible that newer iterations of these programs have more desirable targeting outcomes. At the same time, the discussion around what is a more desirable targeting outcome remains open in many countries, given that fertilizer subsidies often have both agricultural yield growth and social protection as policy objectives. There are generally trade-offs between targeting farmers who are the absolute poorest versus targeting those for whom fertilizer in particular will have the highest marginal production benefits [Haushofer et al., 2025]. Much of the discussion around reform seems to target some combination of the two, such as poor, smallholder farmers who have the capability to increase their agricultural production, which may be challenging to do in practice [Duchoslav and De Weerdt, 2023].

Further complicating matters, evaluations assessing the targeting performance of fertilizers subsidy programs are concentrated in countries with explicitly targeted programs, which currently only reflect a small share of the universe of subsidy programs. In less explicitly targeted programs, there is little current evidence about who benefits from subsidies in practice. This may simply be due to the data challenges associated with beneficiary tracking in less centralized systems, but it also may be the case that policymakers are willingly not collecting this information. Rationales for lack of more focused data collection could include worries about evidence revealing that subsidy programs are not truly universal as claimed, or that subsidy benefit allotments suffer from elite capture issues. However, regardless of intentionality, we generally are lacking evidence that compares the targeting regimes and effectiveness between more and less formally targeted programs. Given that much of the policy reform discussion relies on the assumption that more targeted regimes will lead to better policy outcomes, it is critical to understand if and how much explicit targeting affects beneficiary pools in practice.

3 Methods

3.1 Inclusion/Exclusion Criteria

Many countries have a plethora of programs that subsidize the use of fertilizer in some way. The policy landscape is complex and constantly changing. Hence for the purposes of feasibility and comprehensiveness, we define a scope for the fertilizer subsidy programs that will be included in this review. First, we only consider programs in Low Income Countries (LIC) or Lower-middle Income Countries (LMIC), according to the World Bank's country classifications for 2024-2025. This restriction was placed given that much of the discussion around policy reform focuses on these countries, where agricultural subsidies generally comprise a larger share of government spending [Hill and Resnick, 2025]. Second, we only focus on programs that subsidize inorganic fertilizers. Hence we exclude subsidies for organic fertilizers, as well as subsidies that are meant to cover any production inputs a farmer chooses. This is because inorganic fertilizer subsidies represent the vast majority of existing agricultural subsidy programs, and inorganic fertilizers specifically are associated with significant environmental and health externalities [Chauhan et al., 2012].

Third, we limit the scope to programs that seemed to be currently and continuously active in 2025. This excludes large-scale, long-term subsidy programs that are no longer active, and subsidy programs that were implemented on a one-time basis, for example as part of a disaster-relief program. This is because these type of long-term, well-established programs are generally the ones critics seek to replace, as they consume the highest amount of government resources. Fourth, along similar lines, we restrict our scope to programs that are administered at the national level, primarily by governments or government-affiliated entities (such as parastatal enterprises). This excludes programs that are primarily administered by donors and other non-governmental organizations, as well as programs administered at the sub-national level. This is again to ensure policy relevance; governments have less control over donor-implemented programs, which also tend to last for predetermined fixed periods. Moreover, it can be challenging to both influence policy and find policy information at the sub-national level, hence this restriction makes it feasible to conduct a relatively comprehensive review. Fifth, we only consider programs that subsidize fertilizer itself, not programs that subsidize the interest rate on credit to purchase fertilizer. This is because interest rate subsidies are generally less distortionary than subsidies on fertilizer itself, especially in contexts where uptake of formal lending products low. As such, interest rate subsidies to purchase fertilizer are relatively less common in LICs and LMICs.

Finally, as a logistical constraint, to include a program, we had to be able to find some indication that the program (currently) exists using a comprehensive, multi-lingual internet search, including a mention in an official or quasi-official source. Specifically, we searched on Google and Google Scholar for the terms "fertilizer subsidy [country name]", "input subsidy [country name]", "fertilizer policy [country name]" in both English and a local language if necessary. Any additional eligible policy uncovered while searching for information on other programs using official sources was also included, even if it did not emerge in initial search results. Official or quasi-official sources include government websites or documents, articles in online local news sources, articles in peer-reviewed academic journals, or other websites run by well-known, reputable sources, such as the World Bank or the International Fertilizer Development Center (IFDC). While for the relatively long-run national-level programs we focus on, we do not believe this is leading to the exclusion of any programs, we can not entirely rule out the possibility, given the dearth of publicly available information online from some governments.[1]

[1] In cases where we had reasonable doubts about whether programs existed or were still active, we contacted experts for

3.2 Identification of Targeting Criteria

Next, to categorize the targeting features of each program, we generated a list of targeting criteria, based on a preliminary scoping of program features to identify commonalities. Notably, we considered "explicit criteria" such as stated eligibility conditions, as well as "implicit criteria" which may not intend to change the composition of the beneficiary pool but may end up doing so in practice. The list of criteria we identified is shown in Table 1.

Notably, we have split the identified criteria into four general categories: registration, production choice, eligibility, and subsidy amount determination. The registration criteria describe any processes individuals must complete or infrastructure that individuals must possess in order to register to receive benefits. This includes whether an individual has to register at all (rather than just receiving the subsidized price automatically when purchasing fertilizer) and what other documents or infrastructure is necessary for registration. Some of the registration criteria are likely not meant to be explicit targeting criteria, but rather are needed for the purpose of program administration. For instance, some programs require access to a bank account, likely not because they want to exclude the unbanked, but because the subsidy is delivered through the bank account. Yet other registration criteria may serve an explicit screening function; for example, the need to provide a national identification card or number may seek to ensure that subsidy benefits only go to citizens or other legal residents, or ensure that any one individual doesn't claim more than an allotted amount of subsidized fertilizer. Land documentation similarly may help prove an individual is a farmer or make sure a farmer doesn't claim more subsidized fertilizer than is feasible to use on their land area. More generally, the process of having to register at all (often in a farmer database) may help weed out individuals who are not farmers. Previous research has demonstrated that imposing small hurdles or costs can change the beneficiary pool through a "self-targeting" mechanism [Alatas et al., 2016]. In the best case scenario, only individuals who value the subsidy highly enough are willing to go through the hurdles to obtain it; in the worst case scenario, marginalized individuals who face disproportionately high costs of overcoming these hurdles are screened out.

The second category, production choice criteria, describes ways one must engage in agricultural production in order to qualify for the subsidy. These include the crop an individual seeks to produce, and the agricultural practices one engages in. Generally these are not explicit targeting criteria in that they do not aim to change the composition of the beneficiary pool per se, but rather aim to encourage producers to make the production choices that are associated with the policy. For example, a government may restrict the subsidized fertilizer to use on crops that are in line with strategic production targets. Yet altering crop choice or practices may not be entirely frictionless for farmers, and hence may induce additional targeting. For example, if some crops are seen culturally as "women's crops" versus "men's crops," subsidizing specific crops could change the make-up of the beneficiary pool [Karamba and Winters, 2015].

The third category, eligibility criteria, are explicit targeting criteria describing conditions one must satisfy in order to receive the subsidy. One potential type of eligibility criteria relates to the welfare status of individuals, which we call "income/vulnerability." Such criteria intend to target farmers that are "worse off" in some way. However the particular criteria used in each program tend to be highly context specific, depending on the types of individuals who are vulnerable or have been historically marginalized in that context; in some places, this could be individuals without steady employment, whereas in other places this may be elderly or female-headed households. Hence, for simplicity, we group all such conditions as one type of criteria. The other two types of criteria in this category relate to land holdings. Critically, one of the

verification.

stated objectives of many fertilizer subsidies program is to improve welfare for "small holder farmers," and having a maximum land ownership threshold is one clear way to define who is a smallholder. Some programs have a minimum land holding threshold, perhaps to ensure that subsidized fertilizer is indeed going to actual farmers (rather than say, individuals with a garden) or to more productive farmers operating at large enough scales.

The fourth category is subsidy amount determination criteria, which specify the amount of subsidized fertilizer to which a farmer is entitled. Here we identify two criteria: whether the farmer's alloted amount of the subsidized fertilizer depends on the amount of land they cultivate, and whether there is any official limit on how much subsidized fertilizer any one individual can purchase. (All programs in which fertilizer subsidy amounts are tied to land amounts are considered as having a cap, but some programs may also have caps that are unrelated to land area cultivated.) These are explicit targeting criteria in that they dictate the how fertilizer resources are to be allocated among program beneficiaries. However, they also may serve as implicit criteria dictating who benefits. For example, if the maximum amount of subsidized fertilizer that one can purchase is very low, individuals cultivating large areas of land may not find it worthwhile to go through the ordeals necessary to obtain the subsidy, as the subsidy would only cover a small portion of their overall fertilizer costs.

Once these criteria were established, we assessed each subsidy program to document which targeting criteria were applicable. To do so, we consulted the same types of sources that were used to verify a programs existence, and attempted to capture most recent information available. In some cases when feasible, we also contacted experts for clarification of current targeting features. We also collected additional information on which types of inorganic fertilizers were subsidized and the approximate percentage of the market price covered by the subsidy. In addition, we looked for evidence regarding the stated objectives of the program, and recorded whether there is evidence of social protection being one of the primary objectives of the program. We considered this to be the case if main program objectives included verbiage like "increasing farmers' incomes" or "supporting farmers," rather than phrasing like "increasing agricultural production," and verbiage like "decreasing poverty and hunger," rather than "increasing national food security." For this variable in particular, to the extent possible, we drew on official government documents and direct quotes from government officials in newspaper articles. This is because commentary on program objectives may not be aligned with official objectives. Finally, for countries with a subsidy program, we merge in data from the World Bank Development Indicators on region, per capita GDP, share of the population that is rural, and a government effectiveness score for the purpose of cross-country comparison.[2]

3.3 Categorical Classification

Once we assessed each program on each criterion, we explored the patterns that emerged, looking for clusters of criteria and allocation mechanisms used across multiple programs. Based on this exercise, we created a typology with four broad types, which range from broadly "least" to "most" targeted: universal or near universal, near universal with registration barriers, informally targeted, and formally targeted. Within each type we also characterize various subtypes. The breakdown of types and sub-types can be seen in Figure 1.

[2]According to the Worldwide Governance Indicators' documentation, "Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies [World Bank Group, 2024].

3.3.1 Universal/Near Universal

Universal/near universal programs are intended to reach all farmers, and do not require individuals to complete any formal registration process. A farmer can simply purchase fertilizer at any authorized retailer and the subsidy is automatically incorporated into the sale price. In many of these programs the subsidy is incorporated upstream in the supply chain before the product reaches the consumer, such as by subsidizing fertilizer producers or retailers directly. In some cases, there is a posted "maximum retail price" that is meant to ensure that retailers pass through the subsidy to consumer prices.

We further break this down into two subtypes: "universal" and "identification requirement." In universal programs, no documentation seems to be required at all in order to purchase subsidized fertilizer. In identification requirement programs, farmers provide a national identification card or number, potentially linking the fertilizer purchase to their identity. However, this can just be done at the point of sale; no preregistration is required. Similarly, in this category, it is possible that retailers might ask farmers a few questions to make sure they are not buying an excessive amount of fertilizer for their land, but again, this does not have to be done in advance or verified necessarily.

In terms of the criteria in Table 1, these programs are predominantly characterized by the features that they do not have. We allow for subsidy program in both the universal and identification requirement subtypes to potentially have a crop requirement, as it is possible that programs sell fertilizer formulations that are most suitable for specific crops. In practice this does not occur frequently, but it is possible. In the identification requirement sub-type, we also allow there to be a proof of citizenship requirement. Further we allow there to be a cap on the subsidy amount, which could be linked to reported cultivated area. Because individual's purchases may be linked to their national identification number, this type of quantity restriction is possible. However, none of the other criteria in Table 1 may hold if they are in the universal/near universal type.

3.3.2 Near Universal with Potential Registration Barriers

Programs that are near universal with registration barriers do not impose explicit eligibility criteria, but are characterized by the fact that they require effort and/or resources in order for a potential beneficiary to claim the subsidy. This can induce self-targeting in practice. While arguably all fertilizer subsidies intend to target farmers, programs in this category require individuals to join an official farmer registry or some sort of similar list in order to receive benefits. This registration can act as a self-screening mechanism; individuals who are not farmers may be hesitant to sign up when they know their purchases are being tracked, given that resale for a profit is generally not the intended use of subsidized fertilizer. Hence all programs in this type must satisfy the "registration requirement" criterion from Table 1 including "registration requirement." . Additionally, because registries also tend to capture information on what crops farmers grow and how much land farmers have, this targeting method also opens the possibility of more formally dictating each farmer's allotment based on their reported production plans, before the farmer ever reaches a point of sale.

Under this type, there are three different sub-types, with are characterized by different of registration requirements. The first subtype is state-sponsored contract farming ("contract" in various tables). Programs in this subtype allow farmers to receive subsidized fertilizer on credit, contingent upon the agreement that they will sell their harvest to the government (generally through a state-owned enterprise). Upon selling their harvest, the fraction of the fertilizer price that is not subsidized is deducted from the harvest payment. (Even though the fertilizer is offered on credit, the actual price of the fertilizer is also below market price, which

is why these policies qualify for inclusion.) These policies require farmers to register with the government buyer, comply with specific production practices, and sell their harvest to the government buyer. Hence programs in this subtype category must have both "crop" and "practices" requirements. While these are not explicit targeting criteria, they may very well limit the set of farmers that is willing and able to participate in contract farming.

Second, programs under the "infrastructure requirement" subtype necessitate either access to a mobile phone or to a bank account in order to access the subsidy (so either the "bank account" or "mobile number" condition must hold to be in this subtype). Infrastructure requirements are generally imposed by program implementation constraints. For example, a program delivering subsidy e-vouchers by SMS requires access to a phone number, and a program providing subsidy payments through electronic transfer requires an account to transfer the funds to. These are critically pieces of infrastructure that not all farmers may have, and hence may unintentionally raise the cost of program participation for a selected sample of farmers.

The third subtype, termed "land documentation requirement" requires farmers to have some type of official land documentation. This may be an official document ("land document") like a deed or lease document, or some other type of official identifier such as a parcel identification number or geocoded coordinates ("land mapping/plot identifier"). Requiring land documentation is likely intended to have a screening effect, as individuals who are not farmers and do not have agricultural landholdings are excluded from the program. However even smallholders with legitimate claims to land may not have formal land documentation in LIC or LMIC contexts. Hence requiring land documentation may also induced an additional unintended screening effect, excluding farmers without the proper paperwork. We also note that in some programs, there are both infrastructure and land-documentation requirements. In this case, we categorize the program under both the "infrastructure requirement" and "land document requirement" subtypes.

3.3.3 Informally Targeted

The next category is "informally targeted programs." These programs are often presented by policymakers as "universal," but do not operate this way in practice. Because most countries with fertilizer subsidy policies do not produce their own fertilizer, governments have to procure fertilizer from abroad, at market prices. In countries under the "informally targeted" type, the central government will often ask local agricultural offices or cooperatives to elicit farmers demands for various fertilizers and/or have farmers report on their land area and crop cultivation plans for the coming season. This process may involve farmers joining a formal registry ("registration requirement"), or just reporting on this information to local officials. These demand estimates are then sent to the national level government, who determines how much fertilizer to procure. Generally, the amount of subsidized fertilizer requested exceeds the governments fertilizer subsidy budget. Hence the government procures as much fertilizer as it can, and uses the demand information to get some sense of how the fertilizer should be distributed between localities.

As a result, local agricultural officials/cooperatives receive less fertilizer than farmers requested, and are tasked with allocating the fertilizer received among potential beneficiaries. Because the programs are "universal," there are often no clear guidelines surrounding who should be prioritized. Hence local officials must use their discretion to determine allotments, likely factoring in both farmers' neediness and marginal returns to fertilizer. Hence, it is not true that these programs are universal or "untargeted;" they are just targeted at the sub-national level with poorly documented, locality-specific criteria. All of the programs in this type are classified under a single subtype of "centralized demand elicitation and distribution." Critically, programs in this type/subtype are primarily characterized by the lack of explicit eligibility criteria and of

infrastructure/land document requirements, with the simultaneous presence of some sort of local targeting mechanism.

3.3.4 Formally Targeted

The final category is formally targeted programs. These programs are characterized by requiring at least one of the eligibility criteria listed in Table 1. We also further categorized these programs into two subtypes based on which of these eligibility criteria apply. Programs in the "scale-based targeting" subtype have either a "minimum land holding" requirement, a "maximum land holding" requirement or both. In this subtype, the scale of one's agricultural production determines whether they are able to receive the subsidy. On the other hand, Programs in the "welfare-based" subtype must have "income/vulnerability" targeting criteria. In this subtype, the farmers' underlying welfare status is the determinant of eligibility, regardless of the scale of their production. There are also some programs with both land holding criteria and "income/vulnerability" criteria. For instance, some subsidies target smallholder farmers that also meet welfare conditions, such as not having a consistent salary-based income. We describe such programs as falling into both subtypes.

4 Results: Classification of Subsidy Programs

4.1 Targeting Regimes

Using the procedures outlined in Section 3, we identified 39 national fertilizer subsidy programs/policies in 31 countries. Names and brief descriptions of the subsidy targeting/distribution process of each program are listed in Table 2, and the frequency of each type and subtype is shown in Figure 2. Overall, we identify seven programs with universal/near universal targeting regimes, with four being universal and three requiring basic identification information at the point of sale. Hence few programs are truly universal in nature. Instead, we identify 16 near universal programs with registration barriers, with five being state-sponsored contract farming, five having an infrastructure requirement only, three having a land documentation requirement only, and three having both infrastructure and land documentation requirements. Hence it seems that infrastructure requirements like mobile phone and bank account access, which are used for delivery of program benefits are more common than land documentation requirements, which serve as additional screening tools. We identify six informally targeted programs that have centralized demand elicitation and distribution. Finally, we identify ten formally targeted programs, with four being targeted with production scale-based criteria only, two being targeted with on welfare-based criteria, and four being targeted with both scale-based and welfare-based criteria. Hence scale-based and welfare-based criteria seem to be similarly prevalent in formally targeted programs, with scale-based criteria being slightly more common. Critically, even though most of the empirical evidence we have about the targeting of subsidy programs is based on formally targeted programs, these programs make around a quarter of currently existing national programs.

Table 3 shows the prevalence of the various targeting features listed in Table 1, both for the full sample and separated out by targeting regime type.[3] Around 74% of programs require participants to provide proof of citizenship, and 82% require farmers to register in order to receive the subsidy (all cases except in universal/near universal programs). Given that around half of the universal/near universal cases require some sort of identification to be presented, 90% of programs capture at least some information on subsidy

[3]We conduct analysis at the targeting type level rather than sub-type level because most sub-types only have a few cases, making it challenging to detect systematic trends.

recipients. So governments should in principal be able to track subsidy beneficiaries in most programs, though in some cases this data may sit at the local level. While some infrastructure requirements are present across programs (both under the near universal with registration barriers and formally targeted program types, such requirements are not widespread. Only seven of the 39 programs require access to a bank account and only eight require access to a mobile number. This is also true for land documentation, where six programs require some sort of official plot identifier and seven require a formal land document. Interestingly, the prevalence of these types of infrastructure and land documentation requirements is roughly the same in near universal programs with registration barriers and formally targeted programs. This is perhaps surprising given that the very poorest farmers that many formally targeted farmers seek to benefit are most often the ones who lack infrastructure and formal land documentation.

Specifications about which crops are to be grown with the subsidized fertilizer are common, applying to over 2/3 of programs. Interestingly, this is the most common in formally targeted programs, where all programs target a specific crop or crops. These tend to be staple crops, and sometimes the subsidy also provides the seeds of the crop that they are to grow. On the other hand, crop specifications in programs under the near universal with registration barriers category are more likely to target cash crops. Specifically, programs under the contract subtype all target cotton, much of which is destined for export to international markets. Unsurprisingly, universal and near universal programs are the least likely to target specific crops, given that there are generally not clear monitoring mechanisms in place to ensure compliance. Around 1/3 of programs have some requirements around practices that are to be used on plots with subsidized fertilizer, which are split between near universal programs with registration barriers and formally targeted programs. In the former subtype, these practices generally consist of contracting stipulations. In the latter, these practices vary, but may involve, for example, getting a soil test (Eswatini) agreeing to practice conservation agriculture (Zimbabwe), or agreeing to follow the advice of extension agents about best practices for improving productivity (Honduras).

Six out of the ten formally targeted programs have eligibility conditions that related to welfare criteria. These criteria depend on the context but include earning below a monthly income cap (Eswatini), being categorized as a "vulnerable household" (Ghana and Niger), lacking access to formal credit (Productive Technology Bonus in Honduras), lacking formal employment (Zambia), or being located in A1 resettlement lands (Zimbabwe).[4] Similarly, eight formally targeted programs have production scale-based criteria, including a minimum land holding (3 programs), a maximum land holding (2 programs), both (2 program), or a maximum production scale based on the last season (1 program). In 64% of programs, the amount of the subsidy is tied to land holding, and in 77% there is a limit on the amount of subsidized fertilizers that can be received. Benefit caps are common across programs, except in the universal/near universal type programs. Generally these caps arise naturally because subsidy allocation is based on land area cultivated. However, in formally targeted programs this is only the case around half of the time; while all ten programs have some sort of benefit cap, in only 5 programs this cap is related to total land cultivated. Hence in most programs, it is not possible for farmers to get an unlimited quantity of fertilizer, at lest in practice.

[4]Zambia also requires farmers to be a cooperative member in order to receive benefits, but this is cannot necessarily be considered an indicator of "welfare."

4.2 Trends in Targeting Regimes

4.2.1 Trends by Country Context

To understand if there are patterns in the types of targeting regimes used in various programs, we explore heterogeneity in targeting regimes by contextual features and program characteristics. First, Figure 3 explores differences in targeting regimes by contextual features of each country. Panel 3a explores the break down of subsidy programs by geographical region. First, we note that the majority of programs that we identify (27 out of 39) are located in sub-Saharan Africa. As such, in this region we see the greatest diversity in targeting regimes. In South Asia, we identify six programs, and we identify two programs each in East Asia and the Pacific, Latin America and the Caribbean, and the Middle East and North Africa. Universal and Near Universal programs are only found in South Asia and Sub-Saharan Africa. They are relatively most prevalent in South Asia, where 2/3 of programs are of this type as opposed to around 11% of programs in Sub-Saharan Africa. However, within this type, all of the programs in the identification requirement sub-type are located in South Asia. Near universal programs with registration barriers and located across all regions except for Latin America. These make up the largest share of programs in sub-Saharan Africa (44%) and all of the the programs in the Middle East and North Africa. Programs of the state contracting subtype are exclusively located in sub-Saharan Africa, and specifically are used in the West African cotton sector. The rest of these near universal programs that have registration barriers in sub-Saharan Africa tend to have infrastructure barriers only, except in two cases (Cameroon and Lesotho). On the other hand, both programs in North Africa require formal land documentation. Informally targeted programs are almost entirely located in sub-Saharan Africa as well; five out of six of these programs are located in sub-Saharan Africa, with the remaining program being located in Nepal. Finally, formally targeted programs make up the remaining 26% of programs in sub-Saharan Africa. They also make up both of the programs in Latin America and one program in East Asia. Most formally targeted programs in sub-Saharan Africa use welfare-based criteria to assess eligibility at least in part (all except Malawi's Affordable Input Program and Eswatini's Horticulture Input Subsidy). Hence, despite the small sample size, we do see patterns emerge; programs in Latin America are formally targeted, programs in North Africa require land documentation, universal/near universal programs dominate in South Asia, and near universal programs with registration barriers are most common in sub-Saharan Africa. Additionally, when there are informally targeted programs, they are generally in sub-Saharan Africa.

We next explore potential reasons that could explain different targeting regime choices across region. First, we might think that richer countries are likely to have more formally targeted programs given that a smaller share of the population should be in need of benefits. Panel 3b shows a breakdown of programs with various targeting regimes by level of 2024 GDP per capita.[5] Notably, the overall number of subsidy programs in poorer countries is slightly greater than in relatively higher income countries. Countries with GDP per capita of $2,000 or less comprise 56% of the programs in our sample. We do see to an extent that formally targeted subsidy programs are more prevalent in higher income countries in both absolute and relative terms. Over of subsidy programs in countries with GDP per capita of $3000 are more are formally targeted and we do not see any universal/near universal programs in these countries. However, it is not necessarily the case that universal programs are concentrated in the poorest countries; in fact these seem to be most common in countries with GDP per capita between $1000 and $3000. Interestingly, having near universal programs with registration barriers is pretty evenly spread across income categories. However in poorer countries, barriers

[5]Ethiopia is not included in this analysis, since the value for GDP per capita in 2024 was missing in the World Bank data.

are more related to having to register as a contract farmer, where in richer countries, these registration barriers are more related to having land documentation and cell phone access. Informally targeted programs are also concentrated in countries with GDP per capita of less than $2000. This perhaps makes sense given that informal targeting is driven in part by fertilizer supply shortages and lack of administrative capacity at the national level which may be more likely conditions in poorer countries.

Second, targeting regime choice could potentially depend on what share of the population lives in rural areas (and hence are more likely to practice agriculture). If a very low share of the population practices agriculture than it may be more feasible to have targeted policies rather than large-scale universal programs. At the same time, if a very high share of the population practices agriculture, this may also necessitate some targeting because there would not be enough resources to provide subsidized fertilizer to the entire population of farmers. Hence we might expect to be see more formal targeting at the extremes of the distribution of share of the population that is rural. We see in Panel 3c that this is somewhat the case; formally targeted programs are relatively and absolutely more prevalent in countries where either less than 50% of the population is rural or over 70% of the population is rural. Along the same lines, there are no universal/near universal subsidies in countries where 70% or more of the population is rural. There is no clear pattern between share of the population that is rural and the prevalence of either informal targeting or programs with registration barriers.

Third, choice of targeting regime could depend on the administrative capacity of the national government to administer that program. We may expect to see more informally targeted programs in countries with lower government administrative capacity and more formally targeted programs in countries with higher government administrative capacity. Panel 3d shows the breakdown of targeting regime by the value of an index of government effectiveness, that should in part capture a government's administrative capacity. We see some evidence that informally targeted programs are more concentrated is countries with lower government effectiveness, however this is also true for more formally targeted programs. Hence either administrative capacity does have a clear association with choice of targeting regime, or the government effectiveness measure does not well capture administrative capacity.

Overall, we see some associations between the choice of targeting regime type and a country's income and share of population that is rural. However, these relationships are far from deterministic and we have no evidence that any of these relationships are causal. Other cultural, political, economic, and historical factors likely also play important roles in determining a country's choice of targeting regime.

4.2.2 Trends by Program Characteristics

Choice of targeting regime may also be related to characteristics of the program itself. We explore this possibility in Figure 4. For one, the size of the subsidy provided may be related to the choice of targeting regime. Given that countries generally have fixed budgets to implement fertilizer subsidies, we might expect more targeted programs to have higher percentages of the fertilizer price covered by the subsidy, and conversely, more universal programs to cover a lower share. Market prices and subsidy amounts are quite dynamic over time, hence it is sometimes challenging to determine the exact percentage of the fertilizer price covered by the subsidy. Hence for each program, we simply characterize whether the subsidy covers less than half of the market price, around half of the market price, or more than half of the market price. In Panel 4a, we see the breakdown of relative subsidy value by targeting regime, with types arranged from most targeted to most universal. Indeed, formally targeted programs tend to cover higher shares of the market price of fertilizer, with most programs covering more than half of the market price of fertilizer.

However, among the other targeting regime types, there is no clear pattern of the percentage of the price that the subsidy covers, and programs seem to generally be fairly equally split between the three value categories.

Additionally, fertilizer subsidy programs may have various objectives. When programs have social protection as one of the main motives, we might expect to see more formal targeting, in order for programs to make sure resources are really getting to the poorest and neediest farmers. Hence in Panel 4b, we look at whether programs with stated social protections objectives are more likely to be formally targeted. We find some evidence that this is the case. Though most programs claim social protection in some form as one of their motives (69% of programs), 80% of formally targeted programs have some social protection motivation. On the other end of the spectrum, only 60% of programs under the type near universal programs with registration barriers not have social protection objectives. This lower rate is driven by programs that have land documentation requirements. This seems plausible, given that programs which are not formally targeted but ask for more information about land area, would not be using information about land to assess scale-based eligibility conditions. Hence they likely are interested in documenting information about land area cultivated because the main goal of the subsidy is increasing production rather than necessarily raising farmer incomes. Taken together, it does seem that a program's targeting regime is perhaps determined jointly with other program characteristics.

5 Case Studies

5.1 Case Study Selection and Methods

In order to understand whether different targeting regimes might lead to different outcomes we conduct a comparison of case studies. The goal of the case study exercise is to be able to compare differences in targeting outcomes between programs with different targeting regimes, using household survey data. Hence, to the extent possible we chose countries with targeting regimes that spanned the space of types and subtypes. However, we also wanted to make sure that the case studies were broadly comparable allowing us to contrast the pools of beneficiaries (and especially the progressivity of policies) between cases. Hence we established some inclusion criteria that ultimately left us with eleven case studies, which are listed in Table 4.

Hence, we imposed the following inclusion criteria on case studies. First, the data had to be publicly available online either as a direct download, or after submitting a data request. This was purely a logistical constraint to make the exercise feasible. Second, the data had to have been collected in 2019 or later. This is because we are interested in studying current policies, and hence older data sets would be less informative. Third, there needed to be some way in the data to characterize fertilizer subsidy recipients. Fourth, there had to be at least one demographic of welfare indicator that could be compared between beneficiaries. Because we are interested in policy progressivity, we prioritized data sets with information on consumption expenditures (a proxy for income). However, ultimately to be able to include examples from a larger number of regime subtypes, we included three cases where an income or consumption metric was not available (Rwanda, Sri Lanka, and Tanzania). Finally, when possible, we attempted to get nationally representative survey data. We were able to do this in all but four cases; data from Sri Lanka is from one district (the largest by land area in the country), data from India only includes rural households, and data from Rwanda and Tanzania come from agricultural censuses. We again decided to include these cases in the interest of having case studies that spanned a wider range of targeting regimes and geographical regions.

In practice, figuring out which households are fertilizer subsidy beneficiaries in standard household data

sets is quite challenging, especially in programs that claim to be universal. Hence a few different methods were employed to identify beneficiaries depending on the information available in each data set. In the most ideal case, four household surveys (Honduras, Malawi, Sri Lanka, and Tanzania) had questions that directly asked about whether a household received benefits from a fertilizer subsidy program or purchased subsidized fertilizer. In this case, identifying beneficiaries was fairly straightforward; we just use anyone who reports subsidy receipt. For six of the cases (Benin, Burkina Faso, Côte d'Ivoire, Mali, Rwanda, and Senegal), the surveys did not collect data about fertilizer subsidy receipt, however they did collect data on fertilizer expenditures, including the quantity purchased and price paid. From that, we could calculate a rough unit cost per kilogram of fertilizer paid by each respondent. Cross-referencing information on subsidized fertilizer prices in the time and place each survey was conducted allowed us to characterized who was likely paying a subsidized price. Because survey price data is notoriously noisy, we drew a small band around the subsidized price, and assumed that anyone who reported paying a unit price within that band was a subsidy recipient.[6]

In one final case (India) we found survey data that did not contain information on fertilizer subsidy receipt, nor on price. However, in India subsidized fertilizer prices are set at the national level. Hence individuals should be charged this subsidized price at any store. The survey data contained information on whether an individual purchased fertilizer, as well as whether they reported any difficulties with their fertilizer purchase. The two ways that a farmer would not have been able to get the subsidized price are if either shops were charging above what they were supposed to, or their Aadhaar (national ID number) verification failed. Hence, in the case of this last survey, we count an individual as a subsidy recipient if they report purchasing fertilizer, and don't report experiencing either of these two difficulties, when asked about any difficulties faced in when purchasing fertilizer.

For each data set, we compare beneficiaries to non-beneficiaries on a set of demographic characteristics, which describe both about the household in general and the household head in particular. Household level indicators generally include (as the data allows): an indicator of whether the household is in a rural area, per capita expenditures (converted to 2025 US dollars using purchasing power parity exchange rates from the World Bank Development Indicators), household size, land area in acres, an indicator for whether a household has an official land document, an indicator of whether any household member has a cell phone, and an indicator for whether any household member has a bank account.[7] Household head-related indicators generally include (as the data allows): age, and indicators for gender, disability status, marriage status, literacy, completion of primary education, and having agriculture as their main occupation. When feasible (in all cases except for India, Rwanda, Sri Lanka, and Tanzania), we also compare rural beneficiaries to rural non-beneficiaries, to see if any differences can be explained by the fact that poor households are often concentrated in rural areas, and work agriculture. Additionally, in each country in which we have a suitable consumption metric, we calculate the share of beneficiaries in each quintile of the per capita consumption distribution both for the full population and for the urban population. This allows us to compare the progressivity of the subsidy between programs.

We acknowledge that, especially given the difference in methods of identifying subsidy recipients across data sets, which are in part correlated with the targeting regimes, our methods are imperfect to do a pure

[6]For Burkina Faso, Mali, and Senegal, we used official prices reported in Sylla and Bumpas [2022]. For Benin, we used official prices from Government of the Republic of Benin [2024], for Côte d'Ivoire, we used prices reported in N'cho [2022], and for Rwanda we used prices based on Spielman et al. [2025]. See Table 4 for the exact price bands.

[7]In Sri Lanka, we include an indicator of whether a household receives social safety net benefits as a welfare proxy, given the lack of an income or consumption-based welfare metric. In Rwanda, we include an indicator of whether the respondent is a "small farmer" versus a large farmer, as a (highly imperfect) welfare proxy for similar reasons. In Tanzania, we do not have any welfare proxies

comparison across cases. We do not claim that this analysis is causal; that is, different outcomes should not necessarily be attributed causally to a country's choice of targeting scheme. However, given the lack of evidence around differences in targeting accuracy, useful insights may still arise from this analysis, which can motivate further research looking at the causal effect of targeting regime on targeting outcomes.

5.2 Results

5.2.1 Progressivity of Subsidies in the Overall Population

Figure 5 shows the distribution of subsidy beneficiaries by income quintile, for the seven cases in which we have income data from a representative set of respondents (not just rural respondents). From a quick glance, we can see that most of the policies are progressive, with the largest share of beneficiaries in the first (poorest) quintile, and the shares of beneficiaries decreasing in higher quintiles. Out of all of the cases, Senegal seems to have the most progressive targeting, with the largest share of beneficiaries in the poorest quintile, with Honduras as a close second place. There are two cases in which the targeting is not progressive: Burkina Faso and Malawi. In both of these cases, beneficiary shares seem to be roughly evenly split between quintiles, with slightly smaller shares of beneficiaries at both ends of the distribution.

Most notably, the target regime of the program does not seem to be consistently related to targeting performance. For example, both Burkina Faso and Mali have a state-contract farming-based subsidy for cotton farming in conjunction with a separately informally targeted subsidy. Yet while targeting is progressive in Mali, it is not in Burkina Faso. Similarly both Honduras and Malawi have a formal targeting regime, and yet targeting is progressive in Honduras and not in Malawi. It is possible that the difference in performance between these two formally targeted programs is due to differences in the criteria used for targeting; for example Malawi's Affordable Input Program has a minimum land holding eligibility requirement while Honduras's Productive Technology Bonus does not.[8]

Using a broader set of ten of the case studies, we are also able to look more generally at how subsidy beneficiaries and non-beneficiaries compare across programs.[9] Some common patterns emerge across cases.[10] Subsidy beneficiaries are consistently more likely to live in rural areas, have lower per capita household expenditures, have greater agricultural land area, and are more likely to have agriculture as their main source of outcome. Additionally, in most cases beneficiaries have larger household sizes, are less likely to be literate than the general population, are more likely to be married, and are less likely to be in a female-headed. The only exceptions are Tanzania (where beneficiaries have smaller household sizes), Malawi (where female-headed households are more likely be benefit, perhaps due to former explicit targeting under FISP, and perhaps as a result beneficiaries are non-beneficiaries are equally likely to be married), and Senegal (where beneficiaries are non-beneficiaries are equally likely to be literate).

Looking at some of the other beneficiary characteristics reveals some of the distinctions surrounding who is documented in different schemes. For instance, in Benin, Côte d'Ivoire, and Senegal beneficiaries are more likely to have a formal land document, while in Malawi beneficiaries are less likely to have a formal land document. This could be due to differences in targeting regimes; Malawi's program is formally targeted, where Benin and Côte d'Ivoire both have contract farming based subsidies, in which may require farmers to

[8]However, it is worth noting that the survey data used from Malawi were collected when the Farm Input Subsidy Program was still active and the Affordable Inputs Program had not yet begun. These programs targeted similar populations, but the exact targeting rules might be slightly different.

[9]India is not included here because the data only includes rural beneficiaries.

[10]Tables with results for each specific country case are in the Appendix. In each case, we calculate the mean for each variable among both beneficiaries and non-beneficiaries, and then perform a t-test to see if they are significantly different.

have better land documentation more generally. Access to other infrastructure is similarly mixed. In Benin, Malawi, and Senegal, beneficiaries are less than or equally likely to have a cell phone or bank account. In Mali and Côte d'Ivoire, on the other hand, beneficiaries are more likely to have cell phones and more than or equally likely to have bank accounts. Perhaps further confusing matters, beneficiaries in Burkina Faso are less likely to have bank accounts but more likely to have phones. There is no immediately evident pattern between targeting regimes and these beneficiary characteristics. Further, beneficiaries in Benin, Côte d'Ivoire, Rwanda, and Tanzania have younger household heads on average, and perhaps accordingly are also less likely to be disabled (in Benin and Côte d'Ivoire, where we have data on disability status). This may be in line with the notion that younger, more able, and possibly more tech savvy households are able to obtain subsidies under some contracting schemes and schemes that require using a mobile phone in order to register. On the other hand, beneficiaries in Burkina Faso, Malawi, and Mali tend to be older on average. This suggests perhaps that older, perhaps poorer individuals are more likely to be chosen in programs that are formally or informally targeted.

5.2.2 Progressivity of Subsidies in the Rural Population

Given that beneficiaries are much more likely to live in rural areas than non-beneficiaries and poorer individuals tend to be concentrated in rural areas, it is possible that the subsidy programs are only progressive because they primarily target individuals in rural areas. Within rural areas, there is no guarantee that the subsidies are still progressive; that is, there is no guarantee that poorer farmers are more likely to be targeted than richer farmers. Hence in Figure 6, we explore the progressivity of the subsidies within the rural population alone. There are eight cases for this analysis since we are able to add India, which had data for a rural sample only. We see within rural areas, subsidy benefit allocations are still somewhat progressive, except for in the cases of Burkina Faso and Malawi which were also not progressive in the overall population. However, the degree of progressivity within rural areas is much lower than in the general population; the decline in the share of beneficiaries as incomes increase is much less steep. For example, in the general population in Senegal, there was a difference of about 0.3 between the share of beneficiaries in the first quintile versus the fifth quintile. In the rural sample only, this difference is about halved. This suggests that much of the progressivity of fertilizer subsidy policies simply comes from the fact that they are more likely to target rural producers.

Similarly to above, we can compare other characteristics between beneficiaries to non-beneficiaries in the rural sub-sample (for cases where can distinguish who in the sample is rural), to see if systematically different people are chosen under different targeting regimes. These results are generally present in the bottom panels of the appendix tables. Given that the sample sizes are smaller, we are able to detect fewer statistically significant differences between beneficiaries and non-beneficiaries. However, most of the main qualitative trends still hold. For example, we still find that in most cases beneficiary households have lower per capita consumption that non-beneficiary households in rural areas. However in both India and Malawi, the difference in per capita expenditures between beneficiaries and non-beneficiaries is not statistically significant. In the case of Malawi, this is because the mean per capita consumption in beneficiary and non-beneficiary households are equal. Hence despite that fact that Malawi's program is formally targeted, beneficiaries and not statistically wealthier or poorer.[11] We also see that across all cases, beneficiary households are larger, have more land area than non-beneficiary households and are more likely to have a household head whose

[11] In India, mean income in the non-beneficiary group is about $23 higher, but the sample size is small, and hence we are underpowered to detect a difference.

primary occupation is agriculture. Hence even though most of the subsidy programs are targeting poorer households on average even in rural areas, they are still targeting larger farms. This may be a desirable outcome that many subsidy programs also seek to increase production as an objective.

Moreover, we find that rural beneficiaries are equally or more likely to own a cell phone than rural non-beneficiaries and are equally or less likely to have a primary education. Fertilizer beneficiaries in Côte d'Ivoire and Mali are more likely to have both cell phones and bank accounts than non-beneficiaries. This suggests that perhaps to access to cell phones and bank counts may facilitate participation in state contract farming schemes with fertilizer subsidies. At the same time, in both of these cases beneficiaries are less likely to be literate as well as to have completed primary school. Hence lack of literacy is likely not a main barrier to enrolling in state contract-farming schemes. In general, rural subsidy beneficiaries have have either similar or lower literacy levels and primary education rates compared to rural non-beneficiaries.[12] Hence literacy does not seem to be the major barrier to receiving subsidies under any of the targeting regimes. Taken together with the other evidence, the distinctions between beneficiaries and non-beneficiaries do not systematically differ in many meaningful ways between countries, even when only looking at the rural population.

6 Conclusion

In this paper, we characterize the landscape of current national-level chemical fertilizer subsidy policies. We identify 39 such policies and demonstrate a the relatively diverse range of targeting features across programs. While we identify some formally targeted programs and some universal programs, the targeting of most programs lies in a "gray space" in between these two extremes. Many programs have features that likely may shape the beneficiary pool, such as infrastructure and documentation requirements needed to register. Yet another group of programs claim to be universal, but do not seem to be in practice.

Yet we also find, through an analysis of recent household survey data with eleven case studies, that the targeting regime chosen may not actually shape the beneficiary pool in a highly meaningful way. Regardless of targeting regime, we do not find major differences in targeting outcomes. Subsidy programs are generally progressive, but this seems in large part to be driven by the fact that subsidy receipts are concentrated in rural areas. Yet even in rural areas, we generally find that subsidies go to slightly poorer households that are engaged in larger agricultural operations, regardless of targeting regime. Of course, this result should be interpreted with caution. For one, it was highly challenging to identify subsidy recipients in a consistent way across data sets, so ultimately we do not do this. The way that beneficiaries were defined is potentially correlated with the targeting regime, given that data availability varies systematically with the geographical region of the case study. Moreover, in many of the data sets, we attempt to infer beneficiary status based on reported fertilizer prices paid, which may not be particularly accurate. Additionally, households who do not engage in agriculture but receive subsidized fertilizer anyway, which is an illicit activity, are unlikely to report this in household survey data. Finally, the set of countries for which we can access recent, publicly available survey data to perform a case study is certainly a selected set, which is not representative of the universe of subsidy programs.

Even given all of these data-related caveats, it is still perhaps striking that targeting regime choice is not associated with more pronounced differences in targeting outcomes. According to conversations with experts and evidence from news articles, there are many cases where subsidy programs do not operate in

[12] As with the whole population, Senegal is an exception, with beneficiaries in rural areas being more literate than non-beneficiaries

practice how they are supposed to on paper. Differences in registration processes and eligibility criteria that we think might shape beneficiary pools in theory may not do so in practice if they are simply not being followed. Hence further work exploring compliance with procedures and eligibility criteria in practice will add important context that may help us better understand our results.

Taken together, these findings have important implications for the design of sustainable and equitable agricultural policies. For one, the notion that governments are implementing wide-scale, universal subsidies where most farmers benefit does not seem to bear out empirically. Hence designing reforms from the base notion that palatable replacement policies will need to benefit all farmers is likely misguided. Additionally, simply encouraging countries to implement more explicitly targeted subsidy programs may not necessarily increase the progressivity of these policies, as we do not find evidence that formally targeted programs are more progressive. Such reforms will likely need to be paired with improved beneficiary tracking procedures to make sure the intended beneficiaries are the true beneficiaries in practice. Third, we see that most of the progressivity in fertilizer subsidy policies is driven by the fact that beneficiaries are located in rural areas. Hence less distortionary policies to replace subsidies that target rural areas will also likely be similarly progressive at the macro level. Finally, this exercise calls attention to the lack of data being collected on who is receiving fertilizer subsidies in many countries. Viable efforts for policy reform must first start by collecting more administrative data to have a better idea of who is currently benefiting from subsidy policies.

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7 Tables

Table 1: List of Subsidy Targeting Criteria

Criteria	Category	Description
Proof of Citizenship	Registration	Beneficiaries must provide a national ID card or number.
Registration Requirement	Registration	Beneficiaries must register on some farmer registry or official list before purchase.
Bank Account	Registration	Beneficiaries must have access to a formal bank/ micro-finance account.
Mobile Number	Registration	Beneficiaries must have a mobile number and/or access to a mobile phone.
Land Mapping/Plot Identifier	Registration	Beneficiaries must provide a land identifier or the geocoordinates of their land (possibly captured by program personnel).
Land Document	Registration	Beneficiaries must provide a land title, rental document, or other official document.
Crop	Production Choice	Benefits are meant for farmers that are growing a specific crop.
Practices	Production Choice	Beneficiaries must comply with specific agricultural practice(s).
Income/ Vulnerability	Eligibility	Beneficiaries must be poor or marginalized in some way (context-specific).
Minimum Land Holding	Eligibility	Beneficiaries must own or cultivate at least a minimum area of land.
Maximum Land Holding	Eligibility	Beneficiaries must own or cultivate no more than a maximum area of land.
Amount Tied to Land Holding	Subsidy Amount Determination	The amount of subsidy beneficiaries receive depends on how much land they own or intend to cultivate.
Benefit Cap	Subsidy Amount Determination	There is a stipulated maximum subsidy amount that a beneficiary may receive.

Table 2: Program Descriptions

Type	Sub-Type	Country	Program	Description
Universal/ Near Universal	Universal	Benin	Fertilizer subsidy through the Ministry of Agriculture Livestock, and Fisheries	The government procures fertilizers (urea, NPK, and SSP) and sets a fixed price for which they are sold by authorized local distributors (local cooperatives and SODECO stores).
Universal/ Near Universal	Universal	The Gambia	Fertilizer subsidy through the Ministry of Agriculture	The government procures fertilizers (urea and NPK) and sets a fixed price for which they are sold by authorized local distributors (SECCOs and the private sector).
Universal/ Near Universal	Universal	Guinea	Fertilizer subsidy through the Ministry of Agriculture and Livestock	The government procures fertilizers (urea and NPK) and sets a fixed price for which they are sold by authorized local distributors (National Chamber of Agriculture and the private sector).
Universal/ Near Universal	Universal	Pakistan	Fertilizer subsidy through the Ministry of Industries and Production	The government subsidizes imported urea, with the intention that these subsidies are passed through to consumers.
Universal/ Near Universal	Identification Required	Bangladesh	Fertilizer subsidy through the Ministry of Industries and Production	The government procures fertilizers (urea, TSP, DAP, and MOP) and sets a fixed price for which they are to be sold by authorized local distributors appointed by the Bangladesh. Chemical Industries Corporation. Dealers are told to verify basic identity as a farmer, and sell a quantity that is in line with reported planned production activities.
Universal/ Near Universal	Identification Required	India	Nutrient Based Subsidy Scheme	The government pays fixed subsidy rates per kilogram of each nutrient for various P&K fertilizers directly to manufacturers/ importers upon a farmer's Aadhaar-authenticated purchase of fertilizer. Farmers pay a maximum retail price determined by the private sector, by monitored by the government.

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Table 2 – *Continued from previous page*

Type	Sub-Type	Country	Program	Description
Universal/ Near Universal	Identification Required	India	Urea Subsidy Scheme	The government mandates a fixed maximum retail price for urea. The government pays the difference between this fixed price that the farmer pays and the market price directly to manufacturers/importers upon a farmer's Aadhaar-authenticated purchase of fertilizer.
Near Universal with Registration Barriers	Contract	Benin	Fertilizer subsidy through the Interprofessional Cotton Association (AIC)	The government provides subsidies to the country's major cotton ginners in order for them to provide cotton farmers with a fixed subsidy amount for NPK and urea. Farmers receive fertilizer on credit and pay it back upon selling their harvest.
Near Universal with Registration Barriers	Contract	Burkina Faso	Fertilizer subsidy through the Burkinabe Textile Fibres Society (SOFITEX)	Cotton farmers are offered subsidized fertilizer (NPKSB and urea) on credit, which is paid back upon harvest to SOFITEX.
Near Universal with Registration Barriers	Contract	Chad	Fertilizer subsidy through CotonTchad SN (CTSN)	Cotton farmers are offered subsidized fertilizer (NPK and urea) on credit, which is paid back upon harvest to CTSN.
Near Universal with Registration Barriers	Contract	Côte d'Ivoire	Fertilizer subsidy through Professional Association of Cotton Companies of Côte d'Ivoire (APROCOT-CI)	The government provides subsidies to the country's major cotton ginners in order for them to provide cotton farmers with a fixed subsidy amount for NPK and urea. Farmers receive fertilizer on credit and pay it back upon selling their harvest.
Near Universal with Registration Barriers	Contract	Mali	Fertilizer subsidy through Malian Company for the Development of Textiles (CMDT)	Cotton farmers are offered subsidized fertilizer (NPK, DAP, and urea) on credit, which is paid back upon harvest to CMDT.

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Table 2 – *Continued from previous page*

Type	Sub-Type	Country	Program	Description
Near Universal with Registration Barriers	Infrastructure Requirement	Burundi	National Fertilizer Subsidy Program in Burundi (PNSEB)	Farmers must register in advance with a microfinance organization and make an advance payment for their share of the fertilizer (NPK and NK mixes) price. Farmers then receive a voucher that they can redeem to pick up their order at an authorized suppler, who is then reimbursed by the government.
Near Universal with Registration Barriers	Infrastructure Requirement	Kenya	National Fertilizer Subsidy Program	Farmers must register in a national farmer registry either via phone (USSD app) or though local extension personnel. They then receive e-vouchers with amounts based on their registered acreage via SMS that can be used to purchase fertilizers (DAP, urea, NPK, MOP, CAN, and Sulfate of Ammonia) from National Cereals and Produce Board depots. NCPB depots do not accept cash, hence farmers must generally pay with mobile money or through a bank account.
Near Universal with Registration Barriers	Infrastructure Requirement	Rwanda	Input Subsidy Program	Farmers must register in a national farmer registry via phone (USSD, app or website). They then receive an e-voucher with amounts based on their registered acreage through the system that can be used to purchase fertilizers (DAP, urea, and NPK) from authorized local retailers, who are then reimbursed by the government.
Near Universal with Registration Barriers	Infrastructure Requirement	Rwanda	Coffee fertilizer subsidy through the National Agricultural Export Development Board	Farmers must register in a national farmer registry via phone (USSD, app or website). They then receive fertilizer (NPK) through distribution by One Acre Fund Tubura, who then gets reimbursed the subsidy amount by the government. Fertilizer purchases are tracked in the registry, and completed using mobile money.

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Table 2 – *Continued from previous page*

Type	Sub-Type	Country	Program	Description
Near Universal with Registration Barriers	Infrastructure Requirement	Tanzania	Fertilizer Subsidy Program	The government mandates a subsidized price for DAP and urea. Farmers register with local extension agents and receive a farmer ID number later via SMS message. The farmer then presents this ID number at an authorized local retailer, and the government reimburses retailers based on these sales.
Near Universal with Registration Barriers	Land Documentation Requirement	Lesotho	Intensive Crop Production Subsidy Program	The government mandates a fixed subsidy percentage of the total fertilizer price. Farmers register with local extension agents who perform a land-mapping exercise. The farmer then presents proof of identification and a letter from the extension agent verifying the farmer's land area in order to purchase fertilizer at authorized retailers, who are then reimbursed the subsidy amount by the government.
Near Universal with Registration Barriers	Land Documentation Requirement	Morocco	Fertilizer subsidy through the OCP Group	The government producers fertilizers (ammonium nitrate, urea, and ammonium sulfate) though its state-owned enterprise (OCP group) and sets a fixed price for which they are sold by authorized local distributors (cooperatives and the private sector). Farmers who register with local extension agents, which requires performing a land-mapping exercise and providing proof of land ownership/rental, can purchase subsidized fertilizer from these outlets.

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Table 2 – *Continued from previous page*

Type	Sub-Type	Country	Program	Description
Near Universal with Registration Barriers	Land Documentation Requirement	The Philippines	Fertilizer subsidy through the Rice Competitiveness Enhancement Fund (RCEF)	Farmers must register in a national farmer registry by filling out a form and presenting an official form of identification and official land document. Registered farmers receive discount vouchers which must be presented to authorized local retailers to purchase the subsidized fertilizer (NPK, urea, ammonium sulfate, ammonium phosphate, and MOP) needed to cultivate up to 10 hectares.
Near Universal with Registration Barriers	Infrastructure and Land Documentation Requirements	Cameroon	Cocoa and Coffee Sector Development Fund (FODECC)	Farmers must download an app and register by using a smartphone to GPS-measure their parcels, and entering personal demographic information.Then the farmer needs to make an account with a bank or microfinance institution and make an advance payment for their share of the fertilizer price. They then get a QR code through the app which can be redeemed for inputs when scanned by an authorized supplier, who is then reimbursed by the government.
Near Universal with Registration Barriers	Infrastructure and Land Documentation Requirements	Egypt	Fertilizer subsidy through the Ministry of Agriculture and Land Reclamation	The government requires domestic producers to sell a fixed amount of nitrogen-based fertilizers to the state at a subsidized price in exchange for export permits. Farmers register through cooperatives for a "smart card" which requires provision of an official land document. Getting a card requires the opening of a connected bank account. Fertilizer is then distributed through cooperatives to card-holders.

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Table 2 – *Continued from previous page*

Type	Sub-Type	Country	Program	Description
Near Universal with Registration Barriers	Infrastructure and Land Documentation Requirements	Sri Lanka	Fertilizer subsidy through the Ministry of Agriculture, Livestock, Land and Irrigation	Farmers register for the subsidy program through their agricultural service center, which requires providing a formal land document. The government then directly transfers funds to beneficiaries' bank accounts which are intended to be used for the purchase of fertilizer.
Informally Targeted	Centralized Demand Elicitation and Distribution	Burkina Faso	Fertilizer subsidy through the Ministry of Agriculture, Animal Resources and Fisheries	Farmers fill out a form declaring the crops and land they plan to cultivate, which they then submit to local agricultural offices. These requests and aggregated to determine the allocation of subsidized fertilizers to different regions. Then local agricultural offices play a role in distributing this subsidized fertilizer (urea and NPKSB) locally to farmers.
Informally Targeted	Centralized Demand Elicitation and Distribution	Ethiopia	Fertilizer subsidy through the Ministry of Agriculture	The government conducts a demand elicitation exercise to determine the allocation of subsidized fertilizers to different regions. Then local cooperatives distribute subsidized fertilizer (DAP and urea).
Informally Targeted	Centralized Demand Elicitation and Distribution	Mali	Fertilizer subsidy through the Ministry of Agriculture	Farmers must fill out a paper voucher declaring the crops and land they plan to cultivate, either to the Office du Niger or to a regional directorate of agriculture. Then with this voucher, they will receive a fertilizer (NPK, DAP and urea) allocation either from the Office du Niger or local authorized retailers.
Informally Targeted	Centralized Demand Elicitation and Distribution	Nepal	Fertilizer subsidy through Agricultural Inputs Company Limited (AICL)	Cooperatives collect information on farmers' demand for fertilizer and submit it to the government, who then make regional allocations. Cooperatives are then responsible for distributing subsidized fertilizer (urea, DAP, and MOP).

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Table 2 – *Continued from previous page*

Type	Sub-Type	Country	Program	Description
Informally Targeted	Centralized Demand Elicitation and Distribution	Senegal	Fertilizer subsidy through the Ministry of Agriculture and Rural Equipment	The government conducts a demand elicitation exercise to determine the allocation of subsidized fertilizers to different regions. Then local adminsitrative committees allocate the subsidized fertilizer (NPK, DAP, and urea).
Informally Targeted	Centralized Demand Elicitation and Distribution	Togo	Fertilizer subsidy through the Centralized Agricultural Input Supply and Management Center (CAGIA)	The government determines the allocation of subsidized fertilizers to different regions. Then local prefectural monitoring committees are tasked with distributing fertilizer (NPK and urea) to registered farmers based on their cultivated land area and crop choices.
Formally Targeted	Scale-based Targeting	Eswatini	Horticulture Input Subisdy	Farmers growing at least 1 hectare of eligible horticulture crops, who can provide a land document as well as a market contract/letter of intent and follow certain production practices can receive vouchers from the National Agricultural Marketing Board (NAMBoard) for the purchase of subsidized fertilizer after paying their share upfront to the specified NAMBoard bank account.
Formally Targeted	Scale-based Targeting	Honduras	Coffee Farmer Bonus (Bono Cafetalero)	Small and medium coffee producers (determined by having production in the previous season of less than 300 quintals) who are registered with the Honduran Coffee Institute (IHCAFE), as well as unregistered farmers planting less than 3 *manzanas*, are eligible to receive subsidized NPK fertilizer at program distribution points.
Formally Targeted	Scale-based Targeting	Malawi	Affordable Inputs Program (AIP)	"Productive" registered small-scale farmers who hold 0.4-2.5 hectares of land, belong to farmer organizations, and don't receive support from other programs are eligible to receive subsidized NPK and urea fertilizer through a voucher system.

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Table 2 – *Continued from previous page*

Type	Sub-Type	Country	Program	Description
Formally Targeted	Scale-based Targeting	The Philippines	Corn Production Enhancement Project	Farmers must register in a national farmer registry by filling out a form and presenting an official form of identification and official land document. Registered farmers who cultivate at least 0.5 hectares of corn receive discount vouchers which must be presented to authorized local retailers to purchase the subsidized fertilizer (NPK and urea) needed to cultivate up to 1 hectare.
Formally Targeted	Welfare-based Targeting	Ghana	Planting For Jobs (PFJ)	Farmers must register in a national farmer registry with the help of local extension officials, providing official identification and information about land and area to be cultivated. While most farmers in Ghana are only eligible for subsidized credit to purchase fertilizer under PFJ, female-headed households, elderly farmers, farmers with disabilities, and smallholder farmers with limited access to resources can receive free urea and NPK through the program.
Formally Targeted	Welfare-based Targeting	Niger	Fertilizer subsidy through the Ministry of Agriculture and Livestock	Local municipal committees make a list of the poorest, most vulnerable farmers who will benefit from the program each season. Identified beneficiaries pay their portion upfront at a bank and then receive QR code vouchers to redeem at authorized local retailers for fertilizer (NPK).

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Table 2 – *Continued from previous page*

Type	Sub-Type	Country	Program	Description
Formally Targeted	Scale-Based and Welfare-based Targeting	Eswatini	Farming Input and Tractor Hire Subsidy Program	Farmers must register at their local rural development area office, which includes providing demographic information, such as salary. After assessment, the farmer receives an eligibility determination via SMS. They then must make a payment to cover a their share of the price at a bank or using mobile money, before then being able to retrieve fertilizer (NPK and LAN) from a local authorized supplier. Only farmers making less than E12,000 (approx. $700) per month and with at least 0.5 hectares of land are eligible to receive benefits.
Formally Targeted	Scale-Based and Welfare-based Targeting	Honduras	Productive Technology Bonus (BTP)	Local agricultural officers conduct a census to identify eligible beneficiaries, who then receive free fertilizer (NPK), distributed by local government personnel. In order to be eligible farmers must possess less than 5 *manzanas* of land, and lack access to formal credit.
Formally Targeted	Scale-Based and Welfare-based Targeting	Zambia	Farmer Input Subsidy Program (FISP)	Eligible farmers must visit their local agricultural office, and provide their national identification number and a letter from their village chief confirming their land ownership. Farmers will later get an SMS message with voucher information to be presented in order to purchase subsidized fertilizer (NPK and urea) at local retailers. To be eligible, farmers must have less than 5 hectares of land, belong to a cooperative, and not be formally employed.

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Type	Sub-Type	Country	Program	Description
Formally Targeted	Scale-Based and Welfare-based Targeting	Zimbabwe	Presidential Input Scheme	Local agricultural officers identify and distribute inputs to eligible beneficiaries, who are smallholders practicing conservation agriculture with land located in communal lands, A1 resettlement areas, or small-scale farming areas. Beneficiaries are expected to sell at their harvest to the Grain Marketing Board to continue to be eligible in subsequent years.

Table 3: Program Targeting Descriptors: Summary Statistics by Targeting Type

Variable	Full Sample	Universal/ Near Univesal	Near Universal w/ Registration Barriers	Informally Targeted	Formally Targeted
Proof of Citizenship	74.4%	42.9%	93.8%	33.3%	90.0%
Registration Requirement	82.1%	0.0%	100.0%	100.0%	100.0%
Bank Account	18.0%	0.0%	25.0%	0.0%	30.0%
Mobile Number	18.0%	0.0%	31.3%	0.0%	30.0%
Land Mapping/ Plot Identifier	15.4%	0.0%	31.3%	0.0%	10.0%
Land Document	18.0%	0.0%	25.0%	0.0%	30.0%
Crop	69.2%	14.3%	75.0%	66.7%	100%
Practices	33.3%	0.0%	56.3%	0.0%	40.0%
Income/ Vulnerability Criteria	15.4%	0.0%	0.0%	0.0%	60.0%
Minimum Land Holding	12.8%	0.0%	0.0%	0.0%	50.0%
Maximum Land Holding	7.69%	0.0%	0.0%	0.0%	30.0%
Subsidy Amount Tied to Land Holding	64.1%	14.3%	81.3%	100.0%	50.0%
Benefit Cap	76.9%	14.3%	81.3%	100%	100%
N	39	7	16	6	10

Table 4: Case Study Data

Country	Program Type(s)	Data	Year	Income Metric	Subsidy Recipient Identification
Benin	Universal and Contract	Enquête Harmonisée sur le Conditions de Vie des Ménages	2021-2022	Yes	Report paying at or around the subsidized fertilizer price of 280 FCFA/kg for NPK or urea (200-360 FCFA/kg)
Burkina Faso	Contract and Centralized Elicitation/ Distribution	Enquête Harmonisée sur le Conditions de Vie des Ménages	2021-2022	Yes	Report paying at or around the subsidized fertilizer price of 280 FCFA/kg for NPK or urea (200-360 FCFA/kg)
Côte d'Ivoire	Contract	Enquête Harmonisée sur le Conditions de Vie des Ménages	2021-2022	Yes	Report paying at or around the subsidized fertilizer price of 227 FCFA/kg for NPK (147-307 FCFA/kg) or 295/kg for urea (215-375 FCFA/kg)
Honduras	Scale-based/ Welfare-based Targeting	Encuesta Permanente de Hogares de Propósitos Múltiples	2023	Yes	Report receiving any cash or in-kind benefits from the Productive Technology Bonus
India	Identification Requirement	COVID-19-Related Shocks in Rural India 2020 Survey, Round 3	2020	Yes	Report that they purchased fertilizer and didn't report that they had difficulties with the purchase due to Aadhaar verification failing or due to the store overcharging
Malawi	Scale-based Targeting	Fifth Integrated Household Survey	2019-2020	Yes	Report that they received a coupon for fertilizer or for fertilizer/seeds
Mali	Contract and Centralized Elicitation/ Distribution	Enquête Harmonisée sur le Conditions de Vie des Ménages	2021-2022	Yes	Report paying at or around the subsidized fertilizer price of 220 FCFA/kg for NPK or urea (140-300 FCFA/kg)
Rwanda	Infrastructure Requirement	Seasonal Agriculture Survey, Season A	2024	No	Report paying at or around the subsidized fertilizer price of 700 RwF/kg for NPK (620-780 RwF/kg), 680 Rwf/kg for urea (600-760 RwF/kg), or 750 RwF/kg for DAP (670-830 RwF/kg).
Senegal	Centralized Elicitation/ Distribution	Enquête Harmonisée sur le Conditions de Vie des Ménages	2021-2022	Yes	Report paying at or around the subsidized fertilizer price of 300 FCFA/kg for NPK (220-380 FCFA/kg) or 260 FCFA/kg for urea (180-340 FCFA/kg)
Sri Lanka	Infrastructure and Land Documentation Requirement	Sustainable Intensification of Crop Production in Anuradhapura District, Sri Lanka	2021	No	Report having purchased subsidized fertilizer
Tanzania	Infrastructure Requirement	Tanzania Agricultural Census	2022-2023	No	Report having purchased subsidized fertilizer

8 Figures

Figure 1: Categorization of Fertilizer Subsidy Targeting Regimes, by Type and Sub-Type

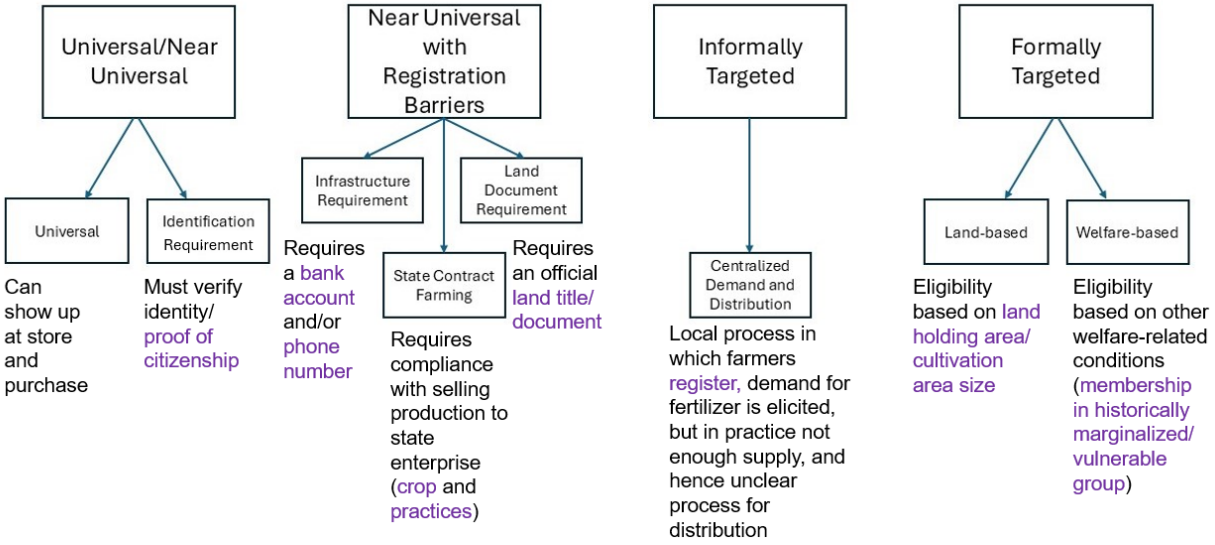


Figure 2: Distribution of Programs by Type and Sub-Type

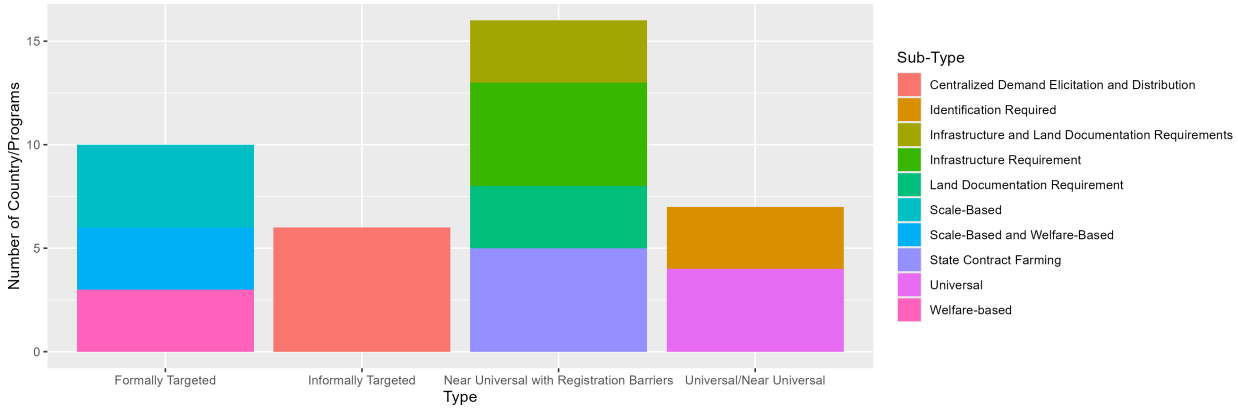
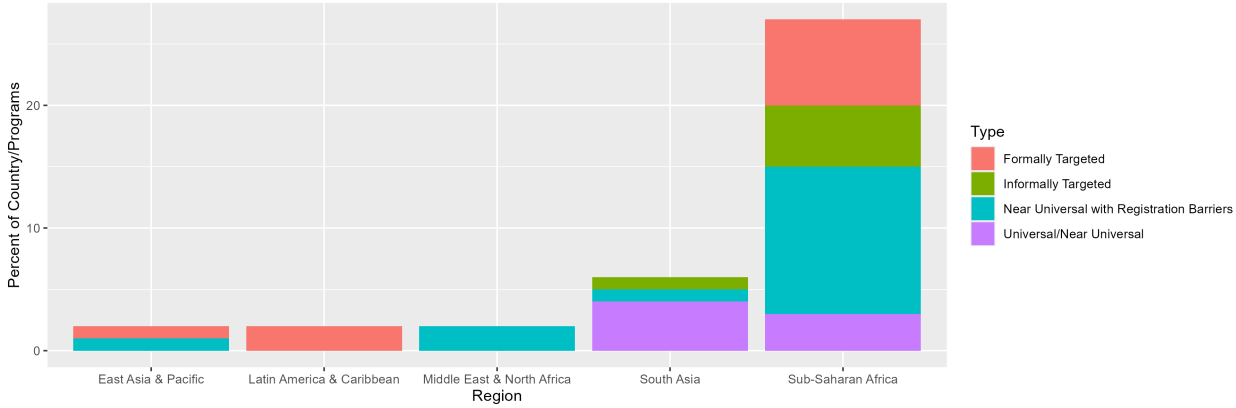
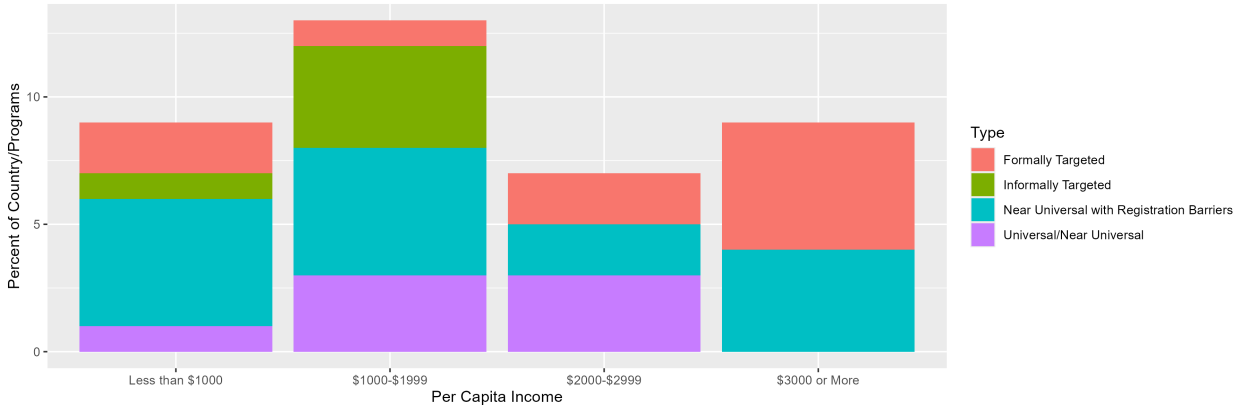


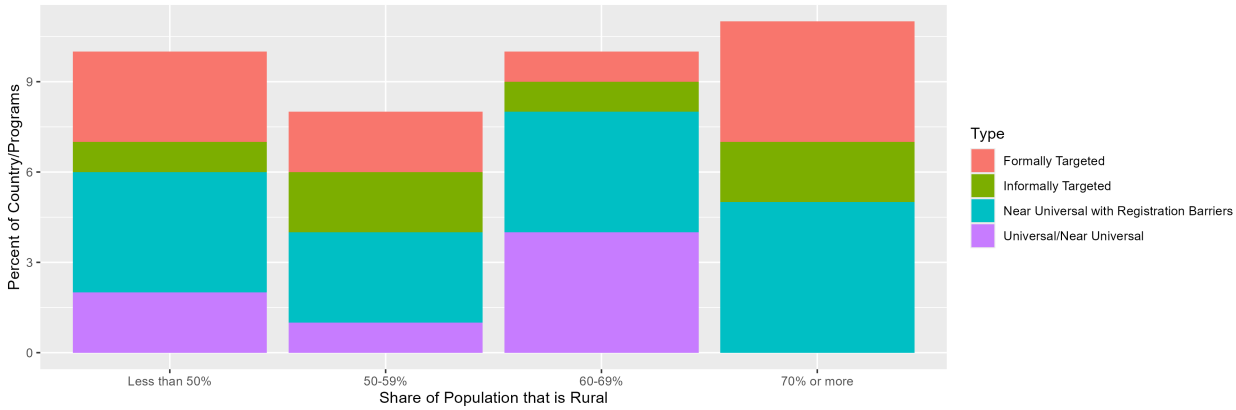
Figure 3: Subsidy Type by Country Characteristics



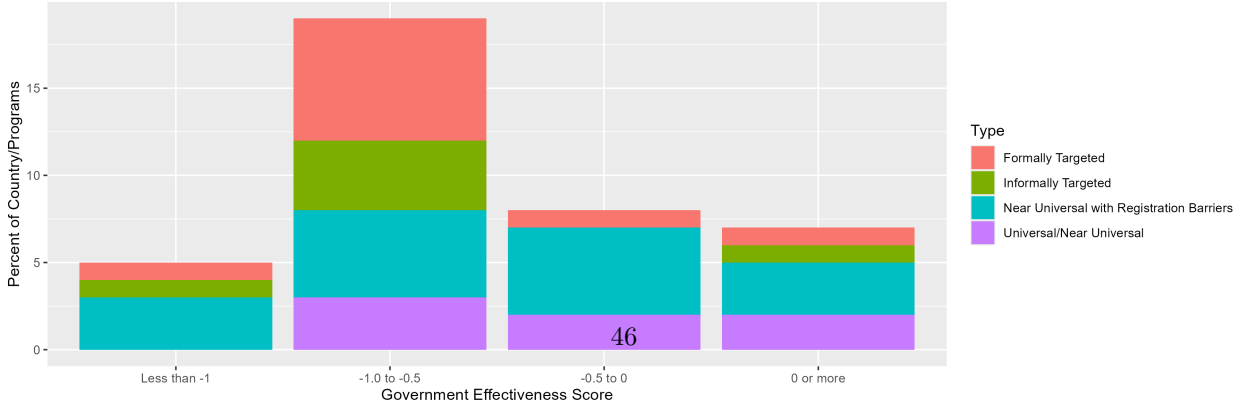
(a) Subsidy Type by Region



(b) Subsidy Type by Country Income

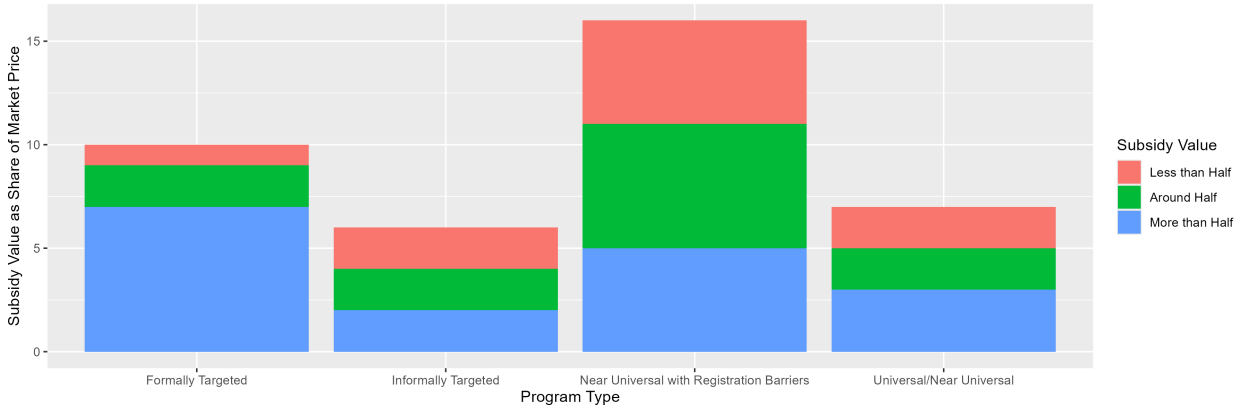


(c) Subsidy Type by Country Share of Population that is Rural

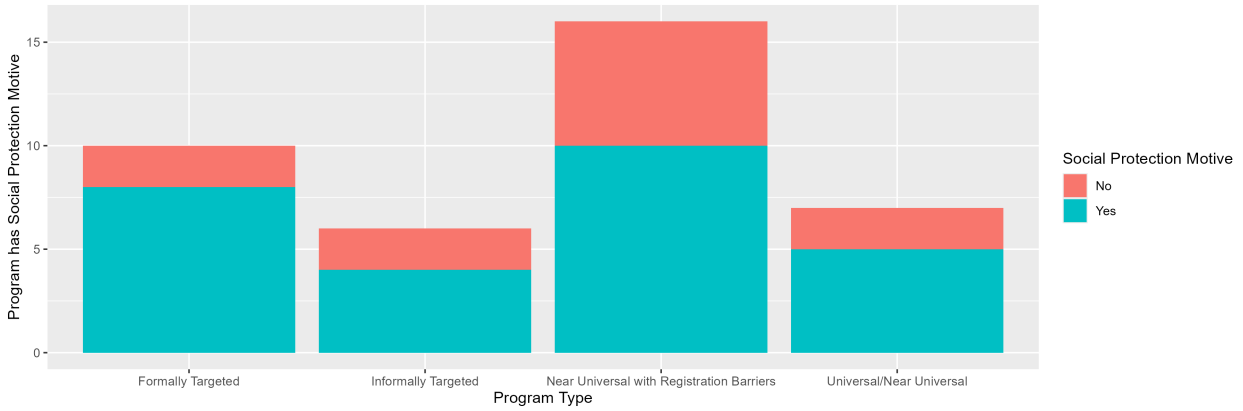


(d) Subsidy Type by Government Effectiveness

Figure 4: Subsidy Type by Policy Characteristics

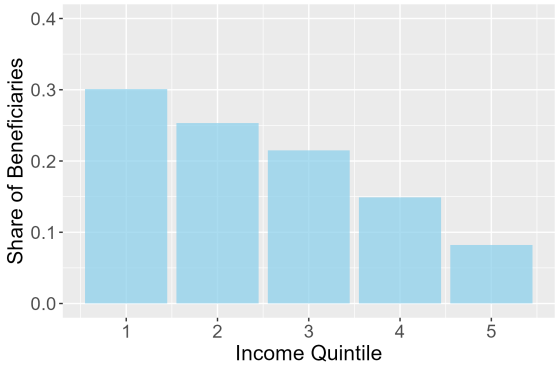


(a) Subsidy Type by Subsidy Value

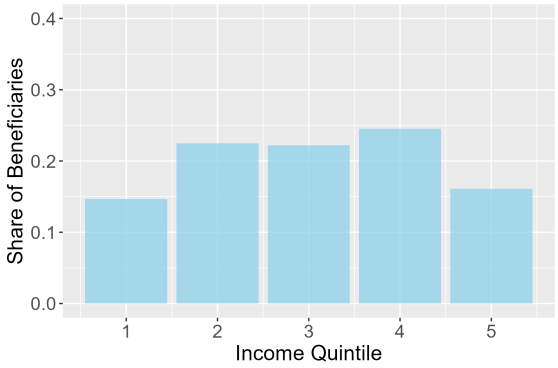


(b) Subsidy Type by Whether the Program has a Stated Social Protection Objective

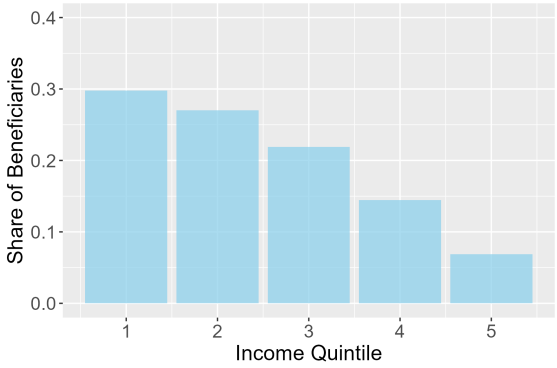
Figure 5: Subsidy Recipients by Income Quintile (Entire Population)



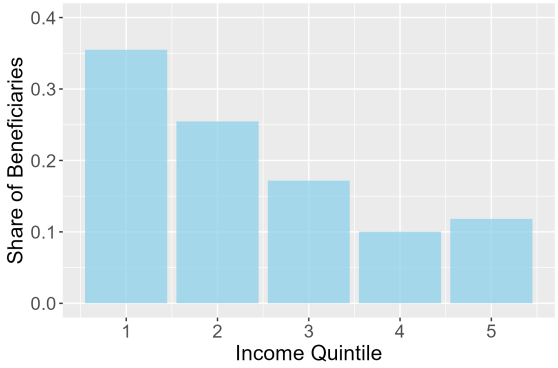
(a) Benin (Universal and Contract)



(b) Burkina Faso (Contract and Centralized)

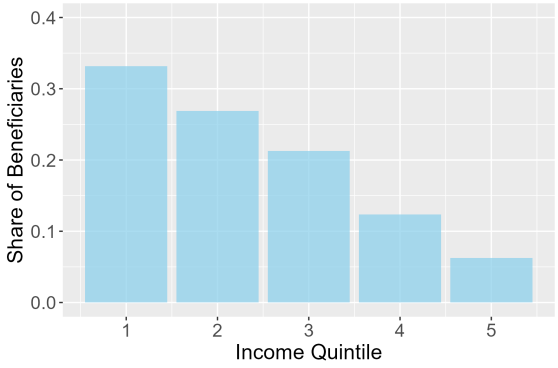


(c) Côte d'Ivoire (Contract)

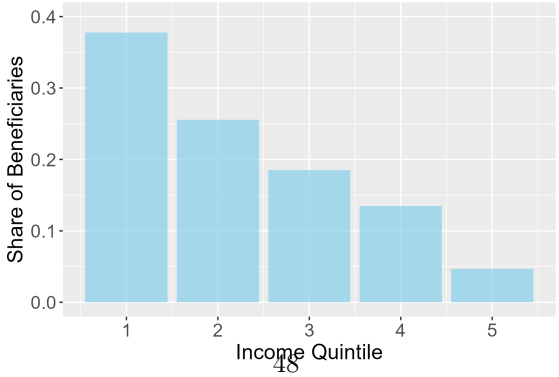


(d) Honduras (Scale-based and Welfare-based Targeting)

(e) Malawi (Scale-based Targeting)

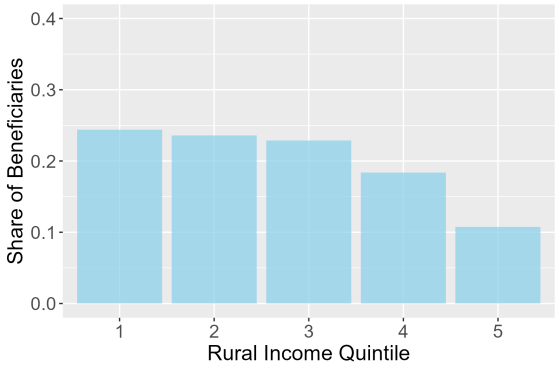


(f) Mali (Contract and Centralized)

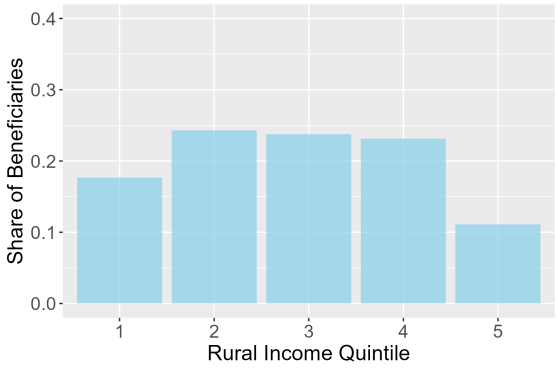


(g) Senegal (Centralized)

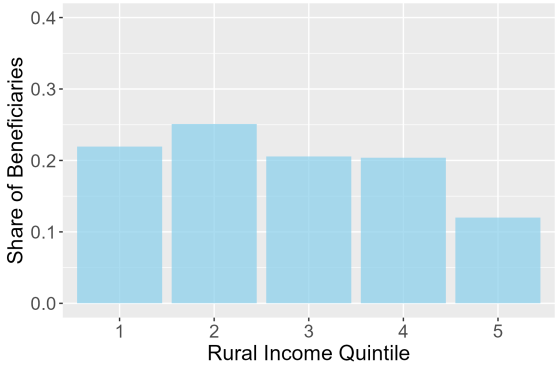
Figure 6: Subsidy Recipients by Income Quintile (Rural Only)



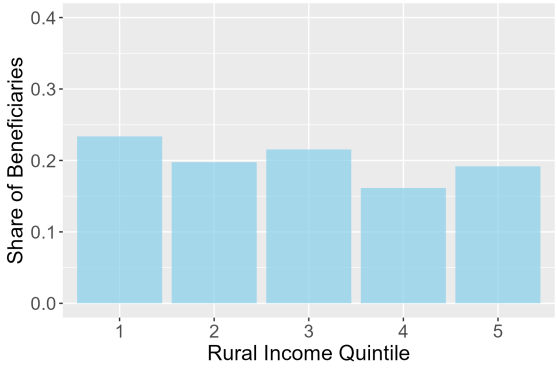
(a) Benin (Universal and Contract)



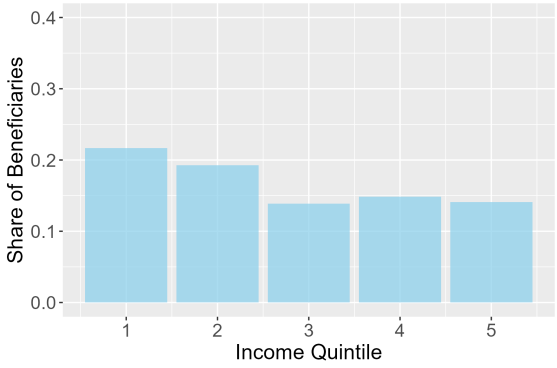
(b) Burkina Faso (Contract and Centralized)



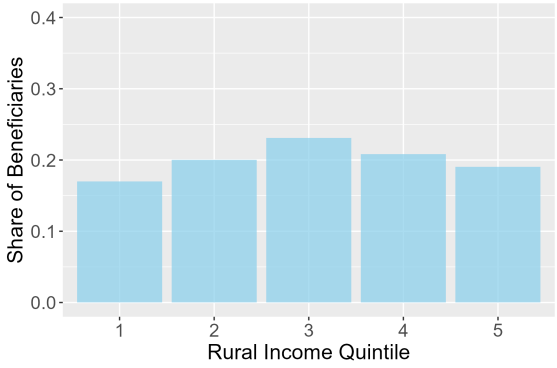
(c) Côte d'Ivoire (Contract)



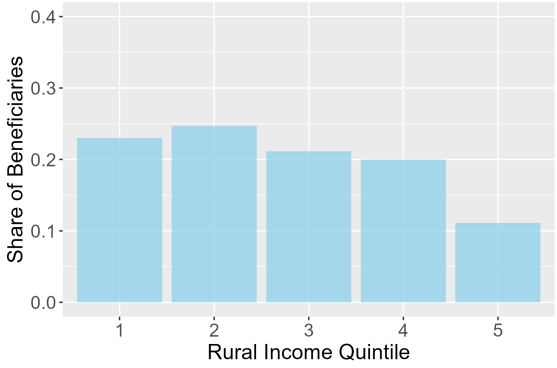
(d) Honduras (Scale-based and Welfare-based Targeting)



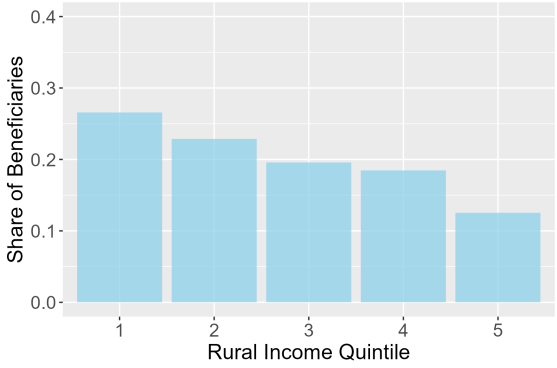
(e) India (ID Requirement)



(f) Malawi (Scale-based Targeting)



(g) Mali (Contract and Centralized)



(h) Senegal (Centralized)

9 Appendix Tables

Table A1: Benin (Universal and Contract)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	P-Value
Rural	6985	0.48	0.5	1047	0.7	0.46	$< 0.001^{***}$
Per Capita Expenditures (Monthly) in 2025 USD PPP	6985	242	188	1047	174	100	$< 0.001^{***}$
Household Size	6985	5.1	2.8	1047	6.5	3.2	$< 0.001^{***}$
Household Land Area (Acres)	6985	2.8	11	1047	8.6	16	$< 0.001^{***}$
Household Has Land Document	6985	0.048	0.21	1047	0.076	0.27	$< 0.001^{***}$
Household Member has Cell Phone	6985	0.92	0.28	1047	0.9	0.3	0.049^{**}
Household Has Bank Account	6985	0.51	0.5	1047	0.38	0.49	$< 0.001^{***}$
Age of Household Head	6985	46	14	1047	45	13	0.046^{**}
Female Household Head	6985	0.23	0.42	1047	0.16	0.37	$< 0.001^{***}$
Disabled Household Head	6985	0.19	0.39	1047	0.15	0.36	0.002^{***}
Married Household Head	6985	0.72	0.45	1047	0.85	0.36	$< 0.001^{***}$
Literate Household Head	6985	0.52	0.5	1047	0.34	0.47	$< 0.001^{***}$
Household Head has Primary Education	6985	0.27	0.44	1047	0.14	0.34	$< 0.001^{***}$
Ag is Primary Occupation (HH Head)	6982	0.3	0.46	1047	0.8	0.4	$< 0.001^{***}$
	Non-Beneficiaries			Beneficiaries			
Rural	N	Mean	SD	N	Mean	SD	P-Value
Per Capita Expenditures (Monthly) in 2025 USD PPP	3346	214	144	734	173	93	$< 0.001^{***}$
Household Size	3346	5.3	2.9	734	6.4	3.2	$< 0.001^{***}$
Household Land Area (Acres)	3346	4.2	13	734	8.4	16	$< 0.001^{***}$
Household Has Land Document	3346	0.072	0.26	734	0.078	0.27	0.596
Household Member has Cell Phone	3346	0.88	0.33	734	0.88	0.33	0.774
Household Has Bank Account	3346	0.41	0.49	734	0.38	0.49	0.11
Age of Household Head	3346	46	15	734	45	13	0.048^{**}
Female Household Head	3346	0.22	0.41	734	0.17	0.38	0.007^{***}
Disabled Household Head	3346	0.18	0.38	734	0.15	0.36	0.042^{**}
Married Household Head	3346	0.74	0.44	734	0.85	0.36	$< 0.001^{***}$
Literate Household Head	3346	0.4	0.49	734	0.31	0.46	$< 0.001^{***}$
Household Head has Primary Education	3346	0.16	0.37	734	0.13	0.33	0.019^{**}
Ag is Primary Occupation (HH Head)	3345	0.45	0.5	734	0.83	0.38	$< 0.001^{***}$

Note: This data comes from the 2021-2022 round of the Enquête Harmonisée sur le Conditions de Vie des Ménages for Benin. Individuals are classified as subsidy beneficiaries if they report paying at or around the subsidized fertilizer price of 280 FCFA/kg for NPK or urea (200-360 FCFA/kg).

Table A2: Burkina Faso (Contract and Centralized Demand Elicitation and Distribution)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	P-Value
Rural	5978	0.48	0.5	1198	0.82	0.39	$< 0.001^{***}$
Per Capita Expenditures (Monthly) in 2025 USD PPP	5978	254	241	1198	168	113	$< 0.001^{***}$
Household Size	5978	6.3	3.8	1198	7.9	4.8	$< 0.001^{***}$
Household Land Area (Acres)	5978	3.9	7.3	1198	12	11	$< 0.001^{***}$
Household Has Land Document	5978	0.027	0.16	1198	0.031	0.17	0.446
Household Member has Cell Phone	5978	0.96	0.19	1198	0.99	0.11	$< 0.001^{***}$
Household Has Bank Account	5978	0.56	0.5	1198	0.43	0.5	0.01^{***}
Age of Household Head	5978	45	15	1198	47	14	$< 0.001^{***}$
Female Household Head	5978	0.17	0.37	1198	0.07	0.26	$< 0.001^{***}$
Disabled Household Head	5978	0.23	0.42	1198	0.23	0.42	0.673
Married Household Head	5978	0.81	0.39	1198	0.91	0.29	$< 0.001^{***}$
Literate Household Head	5978	0.46	0.5	1198	0.33	0.47	$< 0.001^{***}$
Household Head has Primary Education	5978	0.22	0.42	1198	0.073	0.26	$< 0.001^{***}$
Ag is Primary Source of Income	5977	0.33	0.47	1198	0.72	0.45	$< 0.001^{***}$
	Non-Beneficiaries			Beneficiaries			
Rural	N	Mean	SD	N	Mean	SD	P-Value
Per Capita Expenditures (Monthly) in 2025 USD PPP	2858	191	172	980	153	92	$< 0.001^{***}$
Household Size	2858	6.7	4	980	8	4.8	$< 0.001^{***}$
Household Land Area (Acres)	2858	6.7	7.5	980	12	11	$< 0.001^{***}$
Household Has Land Document	2858	0.041	0.2	980	0.02	0.14	0.003^{***}
Household Member has Cell Phone	2858	0.94	0.24	980	0.99	0.12	$< 0.001^{***}$
Household Has Bank Account	2858	0.38	0.49	980	0.38	0.49	0.77
Age of Household Head	2858	46	15	980	47	14	0.064^{*}
Female Household Head	2858	0.15	0.36	980	0.067	0.25	$< 0.001^{***}$
Disabled Household Head	2858	0.25	0.43	980	0.22	0.41	0.026^{**}
Married Household Head	2858	0.84	0.37	980	0.91	0.28	$< 0.001^{***}$
Literate Household Head	2858	0.3	0.46	980	0.3	0.46	0.72
Household Head has Primary Education	2858	0.092	0.29	980	0.054	0.23	$< 0.001^{***}$
Ag is Primary Occupation (HH Head)	2857	0.57	0.5	980	0.78	0.41	$< 0.001^{***}$

Note: This data comes from the 2021-2022 round of the Enquête Harmonisée sur le Conditions de Vie des Ménages for Burkina Faso. Individuals are classified as subsidy beneficiaries if they report paying at or around the subsidized fertilizer price of 280 FCFA/kg for NPK or urea (200-360 FCFA/kg).

Table A3: Côte d'Ivoire (Contract)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	P-Value
Rural	12280	0.58	0.49	685	0.84	0.37	$< 0.001^{***}$
Per Capita Expenditures (Monthtly) in 2025 USD PPP	12280	257	192	685	187	105	$< 0.001^{***}$
Household Size	12280	4.9	2.8	685	6.6	3.3	$< 0.001^{***}$
Household Land Area (Acres)	12280	5.7	10	685	22	19	$< 0.001^{***}$
Household Has Land Document	12280	0.13	0.34	685	0.19	0.39	$< 0.001^{***}$
Household Member has Cell Phone	12280	0.96	0.21	685	0.98	0.14	0.003^{***}
Household Has Bank Account	12280	0.73	0.44	685	0.72	0.45	0.606
Age of Household Head	12280	46	14	685	45	13	0.1^{*}
Female Household Head	12280	0.18	0.39	685	0.036	0.19	$< 0.001^{***}$
Disabled Household Head	12280	0.29	0.45	685	0.22	0.41	$< 0.001^{***}$
Married Household Head	12280	0.67	0.47	685	0.9	0.3	$< 0.001^{***}$
Literate Household Head	12280	0.49	0.5	685	0.29	0.46	$< 0.001^{***}$
Household Head has Primary Education	12279	0.24	0.43	685	0.072	0.26	$< 0.001^{***}$
Ag is Primary Occupation (HH Head)	12280	0.53	0.5	685	0.9	0.3	$< 0.001^{***}$
	Non-Beneficiaries			Beneficiaries			
Rural	N	Mean	SD	N	Mean	SD	P-Value
Per Capita Expenditures (Monthly) in 2025 USD PPP	7148	212	135	574	185	107	$< 0.001^{***}$
Household Size	7148	5	2.8	574	6.5	3.3	$< 0.001^{***}$
Household Land Area (Acres)	7148	8.2	11	574	23	19	$< 0.001^{***}$
Household Has Land Document	7148	0.18	0.38	574	0.2	0.4	0.131
Household Member has Cell Phone	7148	0.94	0.25	574	0.98	0.15	$< 0.001^{***}$
Household Has Bank Account	7148	0.66	0.48	574	0.7	0.46	0.025^{**}
Age of Household Head	7148	46	14	574	45	13	0.014^{**}
Female Household Head	7148	0.15	0.36	574	0.04	0.2	$< 0.001^{***}$
Disabled Household Head	7148	0.29	0.45	574	0.22	0.42	$< 0.001^{***}$
Married Household Head	7148	0.7	0.46	574	0.9	0.3	$< 0.001^{***}$
Literate Household Head	7148	0.4	0.49	574	0.28	0.45	$< 0.001^{***}$
Household Head has Primary Education	7147	0.16	0.37	574	0.063	0.24	$< 0.001^{***}$
Ag is Primary Occupation (HH Head)	7148	0.76	0.43	574	0.92	0.27	$< 0.001^{***}$

Note: This data comes from the 2021-2022 round of the Enquête Harmonisée sur le Conditions de Vie des Ménages for Côte d'Ivoire. Individuals are classified as subsidy beneficiaries if they report paying at or around the subsidized fertilizer price of 227 FCFA/kg for NPK (147-307 FCFA/kg) or 295/kg for urea (215-375 FCFA/kg).

Table A4: Honduras (Scaled-based/Welfare-based Targeting)

	Non-Beneficiaries			Beneficiaries			
Full Population	N	Mean	SD	N	Mean	SD	P-Value
Rural	6315	0.53	0.5	169	0.99	0.11	$< 0.001^{***}$
Per Capita Expenditures (Monthly) in 2025 USD PPP	6087	395	461	169	273	332	$< 0.001^{***}$
Household Size	6315	3.8	1.8	169	4.3	1.8	$< 0.001^{***}$
Household Member has Cell Phone	6228	0.91	0.29	169	0.91	0.29	0.869
Age of Household Head	6315	51	17	169	52	15	0.62
Female Household Head	6315	0.37	0.48	169	0.16	0.37	$< 0.001^{***}$
Disabled Household Head	6315	0.11	0.31	169	0.11	0.31	0.879
Married Household Head	6315	0.3	0.46	169	0.44	0.5	$< 0.001^{***}$
Literate Household Head	6315	0.83	0.37	169	0.72	0.45	$< 0.001^{***}$
Household Head has Primary Education	6257	0.85	0.36	167	0.75	0.43	$< 0.001^{***}$
Ag is Primary Occupation (HH Head)	6226	0.22	0.41	167	0.56	0.5	$< 0.001^{***}$
	Non-Beneficiaries			Beneficiaries			
Rural	N	Mean	SD	N	Mean	SD	P-Value
Per Capita Expenditures (Monthly) in 2025 USD PPP	3224	288	374	167	266	317	0.443
Household Size	3320	3.9	1.9	167	4.3	1.8	0.002^{***}
Household Member has Cell Phone	3283	0.87	0.33	167	0.91	0.29	0.157
Age of Household Head	3320	50	17	167	51	15	0.383
Female Household Head	3320	0.33	0.47	167	0.16	0.36	$< 0.001^{***}$
Disabled Household Head	3320	0.1	0.31	167	0.11	0.31	0.903
Married Household Head	3320	0.32	0.47	167	0.44	0.5	0.001^{***}
Literate Household Head	3320	0.77	0.42	167	0.72	0.45	0.157
Household Head has Primary Education	3288	0.79	0.41	165	0.76	0.43	0.29
Ag is Primary Occupation (HH Head)	3282	0.38	0.49	165	0.57	0.5	$< 0.001^{***}$

Note: This data comes from the 2023 round of the Encuesta Permanente de Hogares de Propósitos Múltiples. Individuals are classified as subsidy beneficiaries if they report receiving any cash or in-kind benefits from the Productive Technology Bonus. (There is no question about the Coffee Farmer Bonus, so this is not captured.)

Table A5: India (ID Requirement)

	Non-Beneficiaries			Beneficiaries			
Rural	N	Mean	SD	N	Mean	SD	P-Value
Per Capita Expenditures (Monthly) in 2025 USD PPP	2785	443	561	1644	420	531	0.166
Household Size	3189	6.2	2.9	1961	6.5	3.2	$< 0.001^{***}$
Household Land Area (Acres)	2561	0.84	3.6	867	6.8	20	$< 0.001^{***}$
Household Member has Cell Phone	2142	0.99	0.094	1148	0.99	0.097	0.838
Household Has Bank Account	1760	0.97	0.18	1122	0.98	0.13	0.005^{***}
Household Head is Female	1056	0.19	0.39	582	0.12	0.32	$< 0.001^{***}$
Household Head has Primary Education	2899	0.34	0.47	1783	0.31	0.46	0.024^{**}

Note: This data comes from the COVID-19-Related Shocks in Rural India 2020 Survey, Round 3. Individuals are classified as subsidy beneficiaries if they report that they purchased fertilizer and didn't report that they had difficulties with the purchase due to Aadhaar verification failing or due to the store overcharging. Note that all households in this sample are rural.

Table A6: Malawi (Scaled-based Targeting)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	P-Value
Rural	10351	0.8	0.4	1083	0.94	0.24	$< 0.001^{***}$
Per Capita Expenditures (Monthly) in 2025 USD PPP	10351	101	133	1083	82	79	$< 0.001^{***}$
Household Size	10351	4.4	2.1	1083	4.7	2.1	$< 0.001^{***}$
Household Land Area (Acres)	10351	1.7	4	1083	2.2	4.3	$< 0.001^{***}$
Household Has Land Document	10347	0.019	0.14	1083	0.01	0.1	0.037^{**}
Household Member has Cell Phone	10351	0.54	0.5	1083	0.5	0.5	0.019^{**}
Household Has Bank Account	10351	0.3	0.46	1083	0.29	0.45	0.64
Age of Household Head	10351	43	16	1083	47	17	$< 0.001^{***}$
Female Household Head	10351	0.29	0.46	1083	0.36	0.48	$< 0.001^{***}$
Disabled Household Head	10351	0.22	0.41	1083	0.28	0.45	$< 0.001^{***}$
Married Household Head	10351	0.7	0.46	1083	0.68	0.47	0.155
Literate Household Head	10351	0.75	0.43	1083	0.71	0.45	0.001^{***}
Household Head has Primary Education	10351	0.43	0.49	1083	0.36	0.48	$< 0.001^{***}$
Ag is Primary Occupation (HH Head)	10351	0.66	0.47	1083	0.76	0.43	$< 0.001^{***}$
	Non-Beneficiaries			Beneficiaries			
Rural	N	Mean	SD	N	Mean	SD	P-Value
Per Capita Expenditures (Monthly) in 2025 USD PPP	8324	81	68	1018	81	79	0.928
Household Size	8324	4.4	2.1	1018	4.6	2.1	0.015^{**}
Household Land Area (Acres)	8324	1.9	4.3	1018	2.3	4.4	0.015^{**}
Household Has Land Document	8323	0.0078	0.088	1018	0.0088	0.094	0.726
Household Member has Cell Phone	8324	0.46	0.5	1018	0.48	0.5	0.32
Household Has Bank Account	8324	0.24	0.43	1018	0.28	0.45	0.006^{***}
Age of Household Head	8324	43	17	1018	48	17	$< 0.001^{***}$
Female Household Head	8324	0.31	0.46	1018	0.37	0.48	$< 0.001^{***}$
Disabled Household Head	8324	0.23	0.42	1018	0.29	0.45	$< 0.001^{***}$
Married Household Head	8324	0.7	0.46	1018	0.68	0.47	0.145
Literate Household Head	8324	0.71	0.45	1018	0.7	0.46	0.444
Household Head has Primary Education	8324	0.36	0.48	1018	0.34	0.47	0.387
Ag is Primary Occupation (HH Head)	8324	0.76	0.43	1018	0.78	0.41	0.099^{*}

Note: This data comes from the Fifth Integrated Household Survey, conducted from 2019-2020. Individuals are classified as subsidy beneficiaries if they report receiving reported that they received a coupon for fertilizer or for fertilizer and seeds. Note that from 2019-2020, Malawi was actually implementing an earlier version of their subsidy program called the Farm Input Subsidy Program (FISP).

Table A7: Mali (Contract and Centralized Demand Elicitation and Distribution)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	P-Value
Rural	5537	0.52	0.5	606	0.87	0.33	$< 0.001^{***}$
Per Capita Expenditures (Monthtly) in 2025 USD PPP	5537	226	154	606	160	97	$< 0.001^{***}$
Household Size	5537	6.8	3.8	606	9.3	5.4	$< 0.001^{***}$
Household Land Area (Acres)	5537	3.8	8.2	606	19	15	$< 0.001^{***}$
Household Has Land Document	5537	0.038	0.19	606	0.046	0.21	0.305
Household Member has Cell Phone	5537	0.86	0.35	606	0.96	0.2	$< 0.001^{***}$
Household Has Bank Account	5537	0.45	0.5	606	0.5	0.5	0.01^{**}
Age of Household Head	5537	50	14	606	52	14	$< 0.001^{***}$
Female Household Head	5537	0.13	0.33	606	0.013	0.11	$< 0.001^{***}$
Disabled Household Head	5537	0.18	0.39	606	0.17	0.38	0.617
Married Household Head	5537	0.88	0.33	606	0.97	0.17	$< 0.001^{***}$
Literate Household Head	5537	0.48	0.5	606	0.31	0.46	$< 0.001^{***}$
Household Head has Primary Education	5537	0.21	0.41	606	0.069	0.25	$< 0.001^{***}$
Ag is Primary Occupation (HH Head)	5537	0.29	0.45	606	0.77	0.42	$< 0.001^{***}$
	Non-Beneficiaries			Beneficiaries			
Rural	N	Mean	SD	N	Mean	SD	P-Value
Per Capita Expenditures (Monthly) in 2025 USD PPP	2881	184	110	530	158	75	$< 0.001^{***}$
Household Size	2881	6.9	3.7	530	9.2	5.1	$< 0.001^{***}$
Household Land Area (Acres)	2881	6.3	10	530	19	15	$< 0.001^{***}$
Household Has Land Document	2881	0.044	0.2	530	0.028	0.17	0.101
Household Member has Cell Phone	2881	0.78	0.42	530	0.96	0.2	$< 0.001^{***}$
Household Has Bank Account	2881	0.3	0.46	530	0.48	0.5	$< 0.001^{***}$
Age of Household Head	2881	51	14	530	52	14	0.039^{**}
Female Household Head	2881	0.1	0.31	530	0.013	0.11	$< 0.001^{***}$
Disabled Household Head	2881	0.17	0.38	530	0.18	0.38	0.884
Married Household Head	2881	0.9	0.3	530	0.97	0.18	$< 0.001^{***}$
Literate Household Head	2881	0.35	0.48	530	0.3	0.46	0.018^{**}
Household Head has Primary Education	2881	0.081	0.27	530	0.06	0.24	0.1^{*}
Ag is Primary Occupation (HH Head)	2881	0.46	0.5	530	0.78	0.42	$< 0.001^{***}$

Note: This data comes from the 2021-2022 round of the Enquête Harmonisée sur le Conditions de Vie des Ménages for Mali. Individuals are classified as subsidy beneficiaries if they report paying at or around the subsidized fertilizer price of 220 FCFA/kg for NPK or urea (140-300 FCFA/kg).

Table A8: Rwanda (Infrastructure Requirement)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	Test
Age	9223	50	15	4925	47	14	$< 0.001^{***}$
Agricultural Land Area (Acres)	9292	2.7	58	5159	28	263	$< 0.001^{***}$
"Small Farmer"	9292	0.99	0.089	5159	0.94	0.23	$< 0.001^{***}$
Female Farmer	9223	0.38	0.49	4925	0.28	0.45	$< 0.001^{***}$

Note: This data comes from the 2024 Season A round of the Seasonal Agriculture Survey. Individuals are classified as subsidy beneficiaries if they report paying at or around the subsidized fertilizer price of 700 RwF/kg for NPK (620-780 RwF/kg), 680 Rwf/kg for urea (600-760 RwF/kg), or 750 RwF/kg for DAP (670-830 RwF/kg). Note that this data does not contain an indicator of whether households are rural or urban, and the sampling level is agricultural plots rather than people.

Table A9: Senegal (Centralized Demand Elicitation and Distribution)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	P-Value
Rural	6564	0.42	0.49	556	0.82	0.39	$< 0.001^{***}$
Per Capita Expenditures (Monthly) in 2025 USD PPP	6564	304	262	556	190	115	$< 0.001^{***}$
Household Size	6564	8.7	5.3	556	12	6.2	$< 0.001^{***}$
Household Land Area (Acres)	6564	2.6	6.4	556	8.5	8.2	$< 0.001^{***}$
Household Has Land Document	6564	0.031	0.17	556	0.1	0.31	$< 0.001^{***}$
Household Member has Cell Phone	6564	0.99	0.097	556	1	0.06	0.161
Household Has Bank Account	6564	0.93	0.25	556	0.91	0.28	0.072^{*}
Age of Household Head	6564	54	14	556	54	13	0.617
Female Household Head	6564	0.3	0.46	556	0.11	0.32	$< 0.001^{***}$
Disabled Household Head	6564	0.25	0.43	556	0.22	0.42	0.169
Married Household Head	6564	0.79	0.41	556	0.91	0.29	$< 0.001^{***}$
Literate Household Head	6564	0.51	0.5	556	0.49	0.5	0.402
Household Head has Primary Education	6564	0.17	0.38	556	0.074	0.26	$< 0.001^{***}$
Ag is Primary Source of Income	4815	0.22	0.42	467	0.61	0.49	$< 0.001^{***}$
	Non-Beneficiaries			Beneficiaries			
Rural	N	Mean	SD	N	Mean	SD	P-Value
Per Capita Expenditures (Monthly) in 2025 USD PPP	2743	223	159	455	182	92	$< 0.001^{***}$
Household Size	2743	9.5	5.5	455	11	6.1	$< 0.001^{***}$
Household Land Area (Acres)	2743	5.4	8.6	455	9.1	8.6	$< 0.001^{***}$
Household Has Land Document	2743	0.049	0.22	455	0.086	0.28	0.001^{***}
Household Member has Cell Phone	2743	0.98	0.12	455	1	0.066	0.059^{*}
Household Has Bank Account	2743	0.9	0.31	455	0.9	0.3	0.623
Age of Household Head	2743	53	14	455	54	13	0.143
Female Household Head	2743	0.22	0.41	455	0.11	0.31	$< 0.001^{***}$
Disabled Household Head	2743	0.22	0.42	455	0.22	0.41	0.74
Married Household Head	2743	0.86	0.35	455	0.92	0.28	$< 0.001^{***}$
Literate Household Head	2743	0.42	0.49	455	0.49	0.5	0.012^{**}
Household Head has Primary Education	2743	0.083	0.28	455	0.062	0.24	0.116
Ag is Primary Occupation (HH Head)	2141	0.43	0.5	385	0.64	0.48	$< 0.001^{***}$

Note: This data comes from the 2021-2022 round of the Enquête Harmonisée sur le Conditions de Vie des Ménages for Senegal. Individuals are classified as subsidy beneficiaries if they report paying at or around the subsidized fertilizer price of 300 FCFA/kg for NPK (220-380 FCFA/kg) or 260 FCFA/kg for urea (180-340 FCFA/kg).

Table A10: Sri Lanka (Infrastructure and Land Documentation Requirement)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	Test
Household Size	100	3.4	1.6	979	3.9	1.4	$< 0.001^{***}$
Household Land Area (Acres)	100	0.61	2.6	979	4.3	4.1	$< 0.001^{***}$
Female Household Head	100	0.2	0.4	978	0.052	0.22	$< 0.001^{***}$
Married Household Head	100	0.94	0.24	976	0.98	0.13	0.007^{***}
Household Head has Primary Education	98	0.92	0.28	961	0.94	0.23	0.331
Household Receives Social Safety Net Benefits	100	0.25	0.44	979	0.26	0.44	0.786

Note: This data comes from the 2021 survey: Sustainable Intensification of Crop Production in Anuradhapura District, Sri Lanka. Individuals are classified as subsidy beneficiaries if they report having purchased subsidized fertilizer. Note that this data does not contain an indicator of whether households are rural or urban.

Table A11: Tanzania (Infrastructure Requirement)

	Non-Beneficiaries			Beneficiaries			
Variable	N	Mean	SD	N	Mean	SD	Test
Household Size	9844	5.2	2.9	1803	4.8	2.5	$< 0.001^{***}$
Household Land Area (Acres)	9843	4.2	9.1	1803	5.5	6.9	$< 0.001^{***}$
Household Head is under 55	9844	0.69	0.46	1803	0.71	0.45	0.036^{**}
Household Head is Female	9844	0.27	0.44	1803	0.23	0.42	0.001^{***}
Household Head has Primary Education	9104	0.64	0.48	1671	0.82	0.39	$< 0.001^{***}$

Note: This data comes from the 2022-2023 round of the Tanzania Agricultural Census. Individuals are classified as subsidy beneficiaries if they report having purchased subsidized fertilizer. Note that this data does not contain an indicator of whether households are rural or urban.