Conditional Contracts in Indirect Local Procurement

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Abstract

Since 2004, the World Food Programme (WFP) has increasingly recognized its potential to stimulate local market development by facilitating small-scale traders' and farmer organizations' access to reliable and profitable markets. Building on this commitment, WFP introduced the Local and Regional Food Procurement Policy (LRFP) in 2019—a strategy aimed at engaging private sector actors, particularly large-scale traders, to enable more cost-effective sourcing while advancing broader development goals such as improved nutrition, resilience, smallholder incomes, livelihoods, and gender equality. This report analyzes systematically collected stack survey data from farmers and traders in western Uganda to evaluate the extent to which the LRFP policy has contributed to these objectives and fostered transformation within local agricultural value chains.

1 Introduction

In crisis situations such as armed conflicts or natural disasters, timely food aid plays a critical role. It not only prevents famine and acute malnutrition in the short term, but also protects households from depleting their assets, thereby reducing long-term hardship. The United Nations World Food Programme (WFP) is at the forefront of these efforts, leveraging a vast logistics network—of up to 5,000 trucks, 80 aircraft and 20 ships in motion daily—to deliver food assistance on an immense scale, reaching 152 million people in 2023 alone (WFP, 2023). In war-torn nations like Syria and Yemen (with conflicts beginning in 2011 and 2015, respectively), WFP has sustained millions of people with staple foods month after month, peaking at about 5.6 million recipients per month in Syria

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and 13 million in Yemen during the worst periods of conflict. The impact of such timely assistance is evident: a famine that emerged in South Sudan in early 2017 was ended within four months due to a concerted large-scale humanitarian response. WFP has also been crucial in sudden natural disasters – for instance, after the February 2023 earthquake in Syria and Turkey, it rapidly provided hot meals and ready-to-eat rations to survivors cut off by the destruction.

Traditionally, WFP obtained the food it distributed directly from donor countries. Tied aid such as this has faced increasing criticism since the late 20th century for its economic inefficiency and negative impacts on recipient countries. The shift towards untied aid gained momentum with international agreements like the 2005 Paris Declaration on Aid Effectiveness, advocating for aid that aligns more closely with the development priorities of recipient countries. WFP followed this trend and started relying more and more on Local purchases (that is, in the affected country) or regional purchases (that is, in a neighboring country or a third country in the region) of the food it needs for its food aid operations.

Uganda, a stable country in a conflict-prone region, has become a crucial player in WFP's efforts to combat food insecurity. As the largest buyer of food commodities in low- and middle-income countries, WFP injected $50 million into Uganda's economy in 2018, purchasing significant quantities of maize, sorghum, and beans. Various WFP initiatives, such as the Purchase for Progress (P4P) pilot, aim to enhance market access for smallholder farmers, improve agricultural outcomes, and foster equitable growth within local food markets. Despite the positive impacts, challenges persist, such as for instance higher costs, market fragmentation and high quality requirements, which compromises the benefits to smallholder farmers. Recent policy shifts towards indirect conditional contracts, which are agreements between WFP and wholesale maize traders requiring that a portion of procurement be sourced directly from smallholder farmers, aim to better integrate these farmers into the supply chain and ensure they benefit more from WFP's stable demand.

Maize, one of the most extensively cultivated staple crop in Uganda, occupies about 30% of the country's cropped land, serving as both a critical food security crop and a vital source of income for farmers. The government has prioritized maize production in its agricultural strategy to enhance national food security and support household livelihoods. The maize value chain in Uganda involves numerous interconnected actors, from agro-input dealers who supply essential inputs like seeds and fertilizers to smallholder farmers, to traders and processors who turn the harvested maize into products like flour for consumer purchase.

Despite government efforts to promote modern agricultural practices, many farmers continue to rely on traditional methods and face challenges such as access to quality inputs, low productivity, and inefficient post-harvest handling that leads to significant losses. These issues, coupled with inefficient market access and processing capabilities, stifle the overall competitiveness of Uganda's maize sector. Traders and small-scale processors play a crucial role in linking farmers to markets and enhancing market participation, even as the sector grapples with challenges in storage, transportation, and price fluctuations influenced

by seasonal and regional dynamics.

This report utilizes observational data that was collected through careful stratification from about 300 trader and 1300 farmers. We also collected qualitative data from wholesalers. Extensive exploratory and descriptive analysis will identify patterns in the data, while econometric techniques like fixed effects models and matching methods will be applied to rigorously attribute causality and separate the effect of indirect conditional contracts from external influences, thereby enhancing the reliability and depth of the findings.

There have been surprisingly few studies on local and regional procurement and virtually none on LRP through the indirect conditional contract modality. Note that while emergency aid corresponds to a supply shock for the recipient country, the country where the food is procured incurs a demand shock, generally due to a single buyer that enters the market with known contracting mechanisms and quality standards. The study that is probably closest to ours is (Upton and Hill, 2011) who examined the effects of local and regional procurement (LRP) of food aid in Uganda through a survey of 120 maize traders, highlighting the complex impacts on local markets. Their study revealed that while LRP can potentially stimulate local economies, it also raises consumer prices and market volatility, complicating the benefits for poor consumers and small-scale farmers.

The remainder of this report is structured as follows. We begin with an explanation of the new procurement modality, focusing on indirect conditional contracting. Next, we provide an overview of Uganda's maize sub-sector, highlighting the roles of farmers, traders, and wholesalers within the value chain. The methods section then outlines the research questions and describes how these are addressed using stack survey data. This is followed by the results, starting with a descriptive analysis and then moving to a more analytical section that explores potential causal relationships. The report concludes with a summary of key findings and policy recommendations based on the evidence.

2 WFP Conditional Contracting

Uganda is a relatively stable country in a region affected by conflict and food insecurity (Upton and Hill, 2011). As a result, it is a key contributor to the World Food Programme (WFP), the world's largest humanitarian organization, which buys more food commodities for its food assistance programs from Uganda than from any other low- and middle-income country. In 2018, WFP invested 50 million USD in the Ugandan economy and purchased over 188,000 metric tons of local food commodities—mainly maize, sorghum and beans—through open tendering from large traders (World Food Programme, 2019). WFP's food assistance programs support disadvantaged populations, including food-insecure households, young children and refugees and internally displaced persons. In Uganda, these programs help address food insecurity and malnutrition and support the growing refugee population while bolstering the country's national social protection system. This is important given that Uganda is cur-

rently Africa's largest refugee hosting country (Global Compact on Refugees, 2018).

Smallholder farmers have been a core focus of WFP's procurement policies for at least two decades. In 2004, the "Food Procurement in Developing Countries" policy was initiated, recognizing the role WFP had to play in developing markets, supporting small traders and farmers' groups and using procurement to encourage smallholder farmers and farmer groups to enter reliable and lucrative markets (World Food Programme, 2006). In 2007, WFP's Home-Grown School Feeding (HGSF) program was launched with the support of the Bill and Melinda Gates Foundation, once again emphasizing the need for local procurement from small producers. Building on the HGSF but greatly expanding its scope and ambition, WFP then launched a 20-country pilot of its Purchase for Progress (P4P) initiative in the wake of the 2007-08 food price crisis. P4P explored procurement modalities with the potential to improve agricultural outcomes and develop country-level food markets in a way that would benefit smallholder farmers (World Food Programme, 2015). In addition to its focus on high quality locally sourced food commodities, the P4P pilot initiative also aimed to strengthen the capacity of smallholder farmers and farmer organizations, and to build linkages to input and service providers and processors (World Food Programme, 2015).

Uganda was one of the pilot countries for the P4P initiative, along with Ethiopia, Kenya, Rwanda, South Sudan and Tanzania in east Africa, and other countries in central, southern and western Africa, Asia and Latin America. Evidence of the impacts of the P4P initiative is mixed: early studies indicate that it improved farmers' access to markets and post-harvest handling (Davies and Menage, 2010 as cited in Upton and Hill, 2011) and improved gender equity (World Food Programme, 2015), though Lentz and Upton (2016) do not find evidence of improved farmer wellbeing in the context of Tanzania despite greater commercialization. In Uganda specifically, large-scale local procurement by WFP appears to have accentuated price speculation among traders and resulted in an equilibrium where two types of maize quality exist: high quality, sold to WFP, and low quality, directed towards the local market (Upton and Hill, 2011).

Despite the fact that 80-90% of food procured was produced by smallholder farmers, WFP procures only a small fraction directly from smallholder farmers via farmer organizations (Leao et al., 2021). An analysis of Uganda's maize value chain revealed fragmentation, lack of integration among players and lack of credit and access to transport for farmers (World Food Programme, 2019). Using regular contracts and open tendering with large traders resulted in about 50% of the cash (market value) reaching smallholder farmers, suggesting that employing both indirect and direct pro-smallholder contract modalities could address imbalances in the maize value chain, potentially increasing benefits for smallholder farmers (Leao et al., 2021). To tackle this, WFP shifted to various contract modalities including both direct and indirect conditional contracts to ensure that smallholder farmers benefit from WFP's stable demand (World Food Programme, 2019).

WFP's current Local and Regional Food Procurement Policy (LRFPP) policy was approved in 2019 and began being implemented in 2020 (World Food Programme (WFP), 2024). Uganda was one of the first countries to implement the indirect conditional contracts to procure maize, instituted in 2021. Conditional indirect contracting generally follow the same principles as traditional contracting, where purchases are announced in the form of national tenders that specify quantity and quality. However, under this type of contract, the condition is added that 20% of the total volume of maize provided by traders must be sourced directly from smallholder farmers, with evidence of purchase (traceability evidence). This conditional contract is the focus of this study.

3 Context and description of maize value chains in Uganda

Maize is one of the most widely cultivated staple crops in Uganda, serving both as a vital food security crop and a key source of income for farmers. Recognizing its importance, the government has prioritized maize production as part of its agricultural strategy to support household livelihoods and strengthen national food security. Maize accounts for approximately 30% of the total cropped land in Uganda, making it the most extensively grown crop, followed by beans at 15% (Uganda Annual Agricultural Survey, 2018).

A typical maize value chain in Uganda involves a network of interconnected actors. At the upstream level, agro-input dealers supply essential inputs such as improved seeds and fertilizers to smallholder farmers. These farmers, in turn, cultivate maize by combining these inputs with land and labor. Once harvested, the marketable surplus is sold to traders, who transport the grain to processors. Processors then transform the raw maize into final products, such as maize flour, which is distributed to retailers and ultimately purchased by consumers. Figure 1 provides an illustration of a stylized maize value chain in Uganda.

Most farmers in Uganda continue to rely on traditional farming methods with limited use of modern agricultural inputs. While some purchase improved seed varieties, such as hybrids or open-pollinated varieties (OPVs), many still depend on saved seeds from previous harvests, constraining potential yield improvements (McGuire and Sperling, 2016). Despite government efforts to promote input use, challenges related to affordability and accessibility persist. Agro-input dealers, primarily based in towns and trading centers, supply essential inputs such as improved seeds, fertilizers, pesticides, and farming tools. However, rural farmers often struggle to access high-quality inputs due to distance, cost barriers, and supply chain inefficiencies. Additionally, concerns over counterfeit or substandard products further discourage investment in improved technologies, as studies have shown that input quality issues are a significant deterrent for farmers (Barriga and Fiala, 2020; Ashour et al., 2019; Bold et al., 2017; Miehe et al., 2023).

As a result of traditional farming methods, maize productivity remains low,

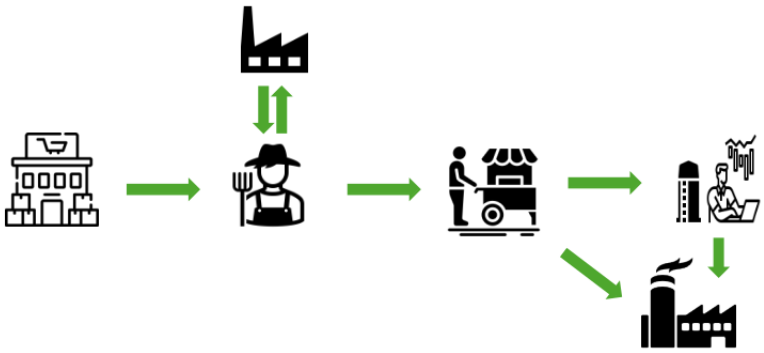


Figure 1: A canonical maize value chain

with average farm yields of about 600 kg per acre, considerably lower than the potential yields reported by research stations, which range from 730 kg to 1,820 kg per acre (Fermont and Benson, 2011; Gourlay, Kilic, and Lobell, 2019). Furthermore, harvesting in Uganda is largely manual, and post-harvest handling remains a significant challenge. Farmers typically dry maize under the sun before shelling and storing it, but inadequate drying techniques and poor storage facilities lead to high post-harvest losses. Common storage methods include traditional granaries and polypropylene bags, though both are vulnerable to pest infestations and moisture buildup, further deteriorating grain quality. These post-harvest inefficiencies contribute to reduced market value and increased vulnerability to seasonal price fluctuations.

Market access is another key challenge for maize farmers. Many smallholder farmers sell maize through informal channels, including farmgate sales to itinerant traders who aggregate maize in trading centers and small towns. Small traders, often using bicycles or motorbikes (boda-bodas), play a crucial role in linking farmers to markets, yet their capacity is constrained by transportation limitations, storage capacity challenges, and fluctuating demand. Wholesale traders purchase maize in bulk—often from small itinerant traders based in rural areas—and supply it to processors or exporters.

The role of traders is often contested, and indeed many development interventions supported by NGOs try to "cut out the middlemen". This is because traders, both small and large, also engage to some extent in arbitrage to capitalize on price seasonality, buying up maize grain from farmers immediately post harvest when prices are low and selling during the lean season when maize is scarce and prices are high (Van Campenhout, Lecoutere, and D'Exelle, 2015a; Burke, Bergquist, and Miguel, 2019). At the same time, research also shows that traders enhance market participation, particularly for remote farmers who would otherwise struggle to sell their produce (Barrett, 2008a; Mather,

Boughton, and Jayne, 2013; Sitko and Jayne, 2014). However, inefficiencies in aggregation, storage, and transportation continue to limit the overall competitiveness of Uganda's maize sector.

Processing is another critical node in the value chain, where maize is transformed into flour, primarily consumed as *posho*—a staple dish made by cooking maize flour with water into a porridge or dough-like consistency. Processing businesses vary widely, from small-scale mills powered by combustion engines (*baga-baga*) that provide milling services for local farmers to large-scale industrial processors that produce fortified maize flour for commercial distribution. High-quality maize flour production requires multiple milling passes and advanced machinery, with some mills equipped for packaging and export.

Uganda's maize flour retail sector is shaped by strong demand, price sensitivity, and evolving consumer preferences. As a staple food, maize flour is consumed widely across all income levels, with demand driven by population growth, urbanization, and food security needs (Erenstein et al., 2022). While formal retailers offer branded, high-quality maize flour, most consumers—especially in rural areas—still rely on informal markets and local mills due to affordability and flexible purchasing options. Regional dietary habits also play a role, with higher maize consumption in northern and eastern Uganda, while central regions traditionally favor matooke. Government policies also impact price and availability, influencing consumer behavior. For instance, under Uganda's Food and Drug Act, producers of maize flour are required to fortify their products with a regulated blend of vitamins and minerals aimed at reducing national micronutrient deficiency.

4 Methods

4.1 Research questions

The overall goal of the study is to assess the impact of the indirect conditional contracts between WFP and large maize traders on maize value chain transformation or upgrading. Within this broader goal, our study poses the following research questions:

- What is the impact of the conditional contract on key outcomes—price realization, mount sold, household income and other welfare indicators—of actors along the value chain, especially for smallholder farmers and small maize traders?
- Does the conditional contract create access to reliable markets, result in value chain transformation or upgrading, e.g., through improved quality standards, and support sustained market engagement between traders and farmers?
- Does the presence of a formal/institutional buyer in an area (e.g. a WFP-affiliated trader or contract scheme) indirectly improve outcomes for nearby smallholders and traders who are not directly contracted? A

large buyer requiring higher quality or offering better prices might spur spillover effects – non-participating farmers could adopt improved practices or get higher farmgate prices due to demonstration or competitive pressure, and independent traders might adjust their buying strategy.

- What are the challenges or barriers faced with respect to conditional contracts? How well are these contracts being implemented on the ground?

4.2 Data and identification

The study took place in Western and Central Uganda (see Figure 2). Maize cultivation plays a vital role in the agricultural landscape of Western and Central Uganda. In these regions, maize is widely grown by smallholder farmers who rely on it for household consumption, income generation, and food security. Additionally, the growing demand for maize from urban markets and agro-industrial processors (both for consumption in Uganda or neighboring countries) has increased its commercial value, encouraging investments in improved production practices and inputs and in storage, handling and aggregation midstream. Furthermore, large parts of eastern Uganda that used to be known for maize production have converted to sugar cane production (Guloba et al., 2023).

The survey for the study of conditional contracts aimed to gather data from three distinct types of actors: smallholder farmers, small traders who act as intermediaries between these farmers and large suppliers, and the large suppliers that are supplying WFP. In a first step, farmers were selected randomly after stratifying them into three groups:

- Group 1: Smallholder farmers from the traceability lists of WFP linked suppliers in four districts: Kasese, Kyegegwa, Kiryandongo, and Masindi. The first two are in the southwestern corner of our study area, closer to lake George, while the last two are in the north of our study area, at the north eastern tip of lake Albert.

- Group 2: Farmers who reside in the same four districts but are not on the traceability list of WFP linked suppliers. In particular, the interview protocol stipulated that nearest neighbor of each Group 1 farmer also needed to be interviewed.

- Group 3: Farmers residing in two districts (Kabarole and Hoima) with characteristics similar to those of Group 1 and 2, but where the WFP was not procuring using the indirect conditional contract modality. In particular, Hoima is in the north of our study area, neighboring Kiryandongo and Masindi. Kabarole is in the southwestern area of our study region, neighboring Kasese and Kyegegwa. These farmers were randomly selected in two stages: first villages 50 villages were selected from a list of all villages, with sampling probabilities proportional to the number of households living in the village. Next, in each village 10 households were randomly selected from the list obtained from the village headquarters.

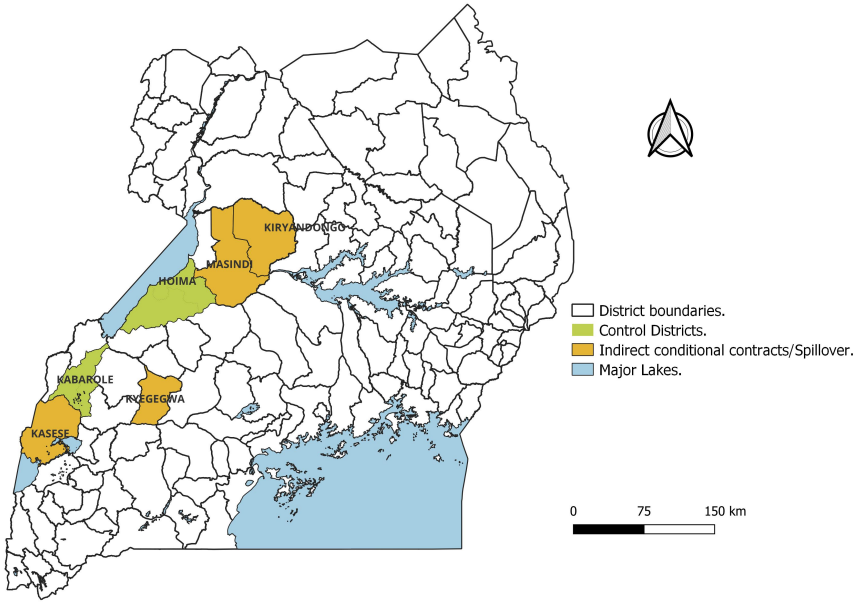


Figure 2: Study area

Traders were identified through referral by farmers. For traders, we only have two groups: those that are operating in areas where WFP was active and those that are operating in areas where WFP is not active. Sample sizes are in Table 1.

The primary identification strategy involves comparing mean outcomes across the three farmer groups for farmer level outcomes and across the two trader groups for trader outcomes. At the farmer level, beyond assessing differences between farmers in areas exposed to WFP's indirect contract policies (group 1) and those in control areas (group 3), we also examine potential spillover effects at the farmer level, comparing group 1 to group 2. This approach allows us to assess whether improved market access mechanisms—such as conditional contracts or institutional buyers—yield broader community benefits or primarily advantage those directly engaged.

Survey data were collected on general household characteristics of farmers and traders, including welfare and food security indicators. The primary focus, however, was on marketing behavior. We gathered detailed information on farmers' maize sales following both the first and second agricultural seasons of 2023, and on maize cultivation during the first and second season of 2023 and the first season of 2024. For traders, data was collected on both purchase and sales transactions for the first and second season of 2023. Additional data was gathered on actors' core business activities: for farmers, this included agricultural technology use and labor inputs; for traders, this encompassed handling

Table 1: Achieved samples of maize farmers and traders by stratification group

Group/Farmer type	Achieved sample	Men	Women	Achieved sample	Men	Women
Group 1: Conditional contract farmers	392	176	216	143	139	4
Group 2: Spillover farmers	389	178	211			
Group 4: Control group farmers	503	270	233	154	147	7
Total	1,284	624	660	297	286	11

and storage practices, as well as access to finance.

Regarding actual engagement with WFP, our data reveal that only about 30% of farmers in policy-exposed areas delivered maize to a WFP-affiliated trader in either season of 2023. From the WFP-linked farmer list, approximately 23% reported selling directly to WFP or through a connected trader. Among spillover farmers, this figure drops to 12%. In contrast, no farmers in control areas reported any sales to WFP, whether directly or indirectly. As such, simply comparing outcomes across groups as we will be doing is likely to severely underestimate true effects. That is, our estimates reflect intention to treat effects in experimental studies.

5 Analysis

5.1 The impact of reliable output markets

One of the main reasons why WFP initiated the indirect conditional contacts modality (and local and regional procurement modalities more in general) is the assumption that the entry of a large credible buyer creates a reliable and predictable market. Indeed, output market uncertainty has been found to be a key constraint to smallholder market participation, which in turn discourages investment in commercial agriculture and intensification (Barrett, 2008b). Furthermore, the presence of a reliable market does not only affect producers. Van Campenhout, Minten, and Swinnen (2021) find that Foreign Direct Investment in various large dairy processing plants in southwester Uganda created a reliable market for raw milk that led to upgrading across the entire value chain. In this section, we trace this impact pathway by first testing if indirect conditional contracts are correlated to market participation. We the look for associations between indirect contracting and investment in technologies and practices. Finally, we look at some production related outcomes.

5.1.1 Market participation

We find that 91 percent of farmers make at least one sales transaction in the first season of 2023, while this figure is 89 in the second season of 2023. The top panel of Table 2 shows how this differs between the three groups of farmers in our sample. In both seasons, while about 85 percent of farmers sell to the market in the control areas, this is closer to 95 percent in the Indirect contract group.

We also find significant differences in quantities sold. For instance, we find that quantity sold is higher in the indirect contract group than in the control group, significantly so in the first season (p-value = 0.067). However, quantities sold are similar in control and spillover groups. In fact, in the first season of 2023, quantities sold are actually lower in the spillover group than in the control group, but the difference is not significant (p-value = 0.458).

Finally, the table also expressed quantities sold as a share of quantities produced to arrive a measure for marketable surplus. While it is not clear that the

Table 2: market participation

	Control	Spillover	Indirect
	sold (yes/no) (%)		
Season 1	85	94	96
Season 2	81	92	94
	quantity sold (kg)		
Season 1	1639	1483	2199
Season 2	1476	1449	1661
	share sold (%)		
Season 1	63	66	72
Season 2	68	73	75

marketable surplus is higher in the spillover group than in the control group, the surplus clearly dominates in the indirect conditional contract group.

Our stack survey allows us to also look at market participation patterns at the trader level. To check is the intervention led to traders entering the market, we asked how many other maize buyer/traders operate in the areas where the trader usually buys maize. We find that on average, there are about 6.41 other traders working in the area. This is 9.23 in areas where the policy is implemented, and the difference is significant (p-value = 0.002). This seems to suggest that the policy is positively related to competition among aggregators.

5.1.2 Adoption of technologies

We next test if reliable market access crowds in good agronomic practices (GAP) and modern technologies such as improved seed varieties and inorganic fertilizer. We investigate this only for the first season of 2023. Results of adoption by different groups is summarized in Table 3.

A first outcome we look at is the use of chemicals. Use of pesticides, herbicides and fungicides is very high in Uganda. Most are pesticides against fall armyworm and maize stem borers. We see that in the control group, just under 60 percent of farmers are using some kind of chemical on a randomly selected field.[1] This is slightly lower in the other two groups.

Next, we look at use of improved maize seed varieties obtained from a trusted source (generally as opposed farmer saved seed). Adoption of improved seed varieties is more in line with expectations. In the control group, 37 percent of farmers indicate that they are using improved seed varieties on the randomly selected plot. This increases to 47 percent for spillover farmers and 57 percent

[1] We did not ask about adoption on all plots, but instead asked farmers to enumerate all plots and then randomly selected one plot on which detailed questions on technology adoption were asked.

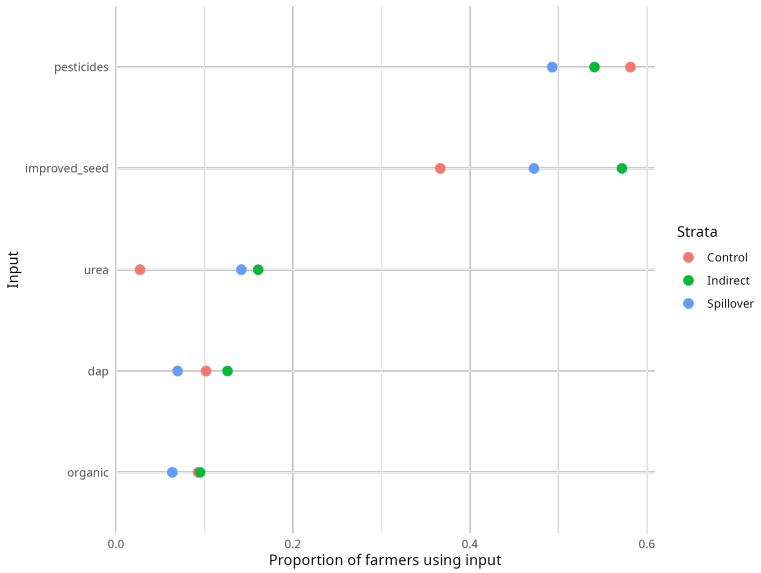


Figure 3: Adoption of agricultural inputs

for farmers affected by the policy. This suggests that access to reliable markets increase the adoption of improved seed varieties.

The picture for fertilizer adoption is mixed. First of all, Figure 3 illustrates that farmers in Uganda are not in a habit of using fertilizer. Only about 10 percent of farmers apply DAP and organic fertilizer, and this does not seem to be correlated to exposure to the policy. For Urea, we do see that farmers that live in areas affected by the policy, adoption improves substantially.

Overall, it seems that reliable market access affects input use. It may be that stricter quality standards refrain farmers from using excessive amounts of chemicals. Furthermore, we see clear effects of the policy on the use of seed of improved varieties and of urea.

5.1.3 Production

Finally we test if the policy also leads to changes in terms of production. We start by testing if farmers that are likely to be affected by the policy, either directly or indirectly, are more likely to cultivate maize, and if so, if they allocate a larger area to maize production. Figure 4 illustrates both the propensity to produce and the area under cultivation in three seasons. For example, in the first season of 2023, approximately 94 % of the farmers who were directly exposed to the policy cultivated maize. In comparison, only 88 % of farmers in the control group did so.

It is important to acknowledge that these figures may be somewhat inflated due to the inclusion criterion that required farmers to have cultivated maize

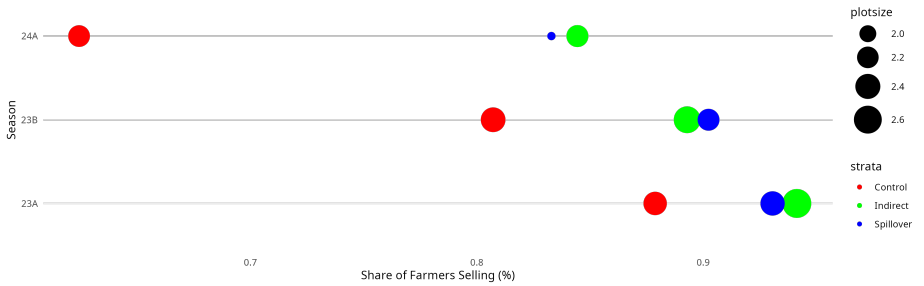


Figure 4: Production

in at least one season. Nonetheless, the key point is the observed distinction between the control group and those in the spillover and indirect contracting groups. Over time, even as the overall proportion declines, the data increasingly indicate that farmers influenced by the policy are more likely to continue growing maize.

The figure also shows that area planted seems to be larger in locations that are exposed to indirect conditional contracting. For instance, while the average area planted with maize is about 2.7 acres in the first season of 2023 for treatment and spillover farmers, this is only 2.3 acres for control farmers.

Figure 5 incorporates production into the analysis by examining how it evolves over time, specifically assessing whether exposure to the policy leads to increased productivity. The vertical axis displays changes in production across different treatment groups. With data spanning three seasons, the figure captures two key transitions: the change from the first to the second season of 2023 (indicated by circles) and from the second season of 2023 to the first season of 2024 (indicated by triangles).

Between the first and second seasons of 2023 (23A–23B) there is no change in average quantity of maize produced in the control group. Similarly, for this group, the average area from which this quantity was obtained remained the same, leading us to conclude that productivity was stable in this group. For the indirect conditional contracting group as well as the spillover farmers, production also remained the same on average. However, for these groups, the area on which maize was grown declined, leading us to conclude that productivity increased between the first and second season.

Between the second season of 2023 and the first season of 2024 (23B-24A), all groups experience significant declines in both production and area used for maize. However, at least for the spillover group, the reduction in production is smaller than the reduction for the control, while the reduction in plot size is larger than for the control. As such, while productivity reduced for both groups, reduction in productivity is largest in the control group.

The trader level equivalent of production would be volumes of maize moved through trader networks. We find that in the first season of 2023, the average

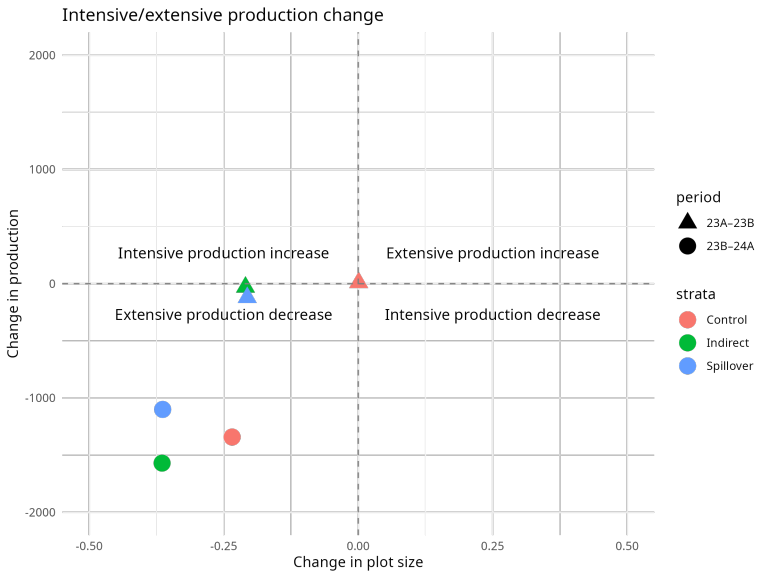


Figure 5: Production and plot size change over time

trader in the control group traded about 73.04 metric tons of maize. In the indirect/spillover group, traders handle about 79.45 metric tons of maize. In the second season of 2023, the figures are 74.78 metric tons and 98.64 metric tons respectively. This suggests that the policy does not only draw traders into the market, it may also incentivize greater investment in aggregation, processing, or transport capacity, thereby amplifying market throughput. The growing divergence in trade volumes across seasons reinforces the idea that WFP's procurement modality can stimulate scaling behaviors among intermediaries, potentially improving efficiency in the maize value chain.

5.1.4 Consumption expenditure and food security

TODO

5.2 Commodity flows

The previous section showed that the policy was associated with increased production and higher volumes handled. In this section, we take a closer look at commodity flows within the value chain. Specifically, from the trader's perspective, we examine how the origins and destinations of traded maize have shifted over time.

To explore these dynamics, we begin with trader-level data. In addition to collecting information on the quantities of maize procured (see Section 5.1.3, we asked traders to report the origin of their purchases as a share of total vol-

ume. Similarly, traders were also asked to indicate the distribution of their sales across different buyer types, expressed as percentage shares. This information is summarized in Figure 6.

The figure illustrates that the majority of maize procured by traders—approximately 65 percent—comes directly from farmers, with this share being consistent across both treatment and control groups. Fellow traders also represent a significant source, with a slightly higher share observed in policy-exposed areas compared to the control group (24 percent versus 20 percent). In addition, traders operating in areas where the policy was implemented source more maize from markets than their counterparts in control areas. Notably, the volume procured from cooperatives is three times higher in treatment areas than in control areas. Qualitative insights suggest that this difference may stem from the policy's requirement for farmer registration, a process that is often more straightforward when dealing with cooperatives, which typically maintain existing farmer registries.

On the downstream side, most maize is sold to wholesalers not linked to WFP. In areas affected by the policy, a similar share is also sold to other downstream traders. Notably, in control areas, a large portion of sales is recorded under "other buyers"—a residual category used when reported shares did not sum to 100 percent. As expected, traders in control areas rarely sell to WFP, either directly or through WFP-affiliated wholesalers. In contrast, approximately 10 percent of maize traded in the treatment areas is supplied to WFP.

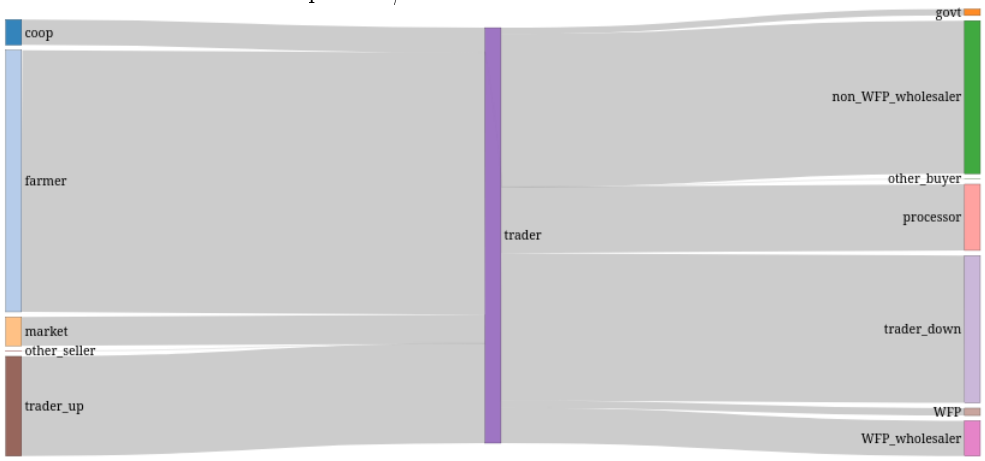
5.3 Price margin analysis

Central to many value chain studies is the question of how rents are distributed over different value chain actors. A convenient way to illustrate this is by price spread plots, that plot prices received by the actor upstream (eg the farmer) against prices received by the actor downstream (eg the trader). One can then plot a 45 degree line, were prices paid to upstream actors are equal to prices received from downstream actors. As such, points above the 45 degree line represent transactions were the downstream actor earns a positive margin, while points below the 45 degree line are instances where a loss is incurred as commodities are sold at lower prices than at which they were bought.

We start by using data at the trader level. Traders were asked about both prices at which they buy maize (mostly from farmers) and prices at which they sell maize further downstream (mostly to wholesale traders - see Section 5.2). Figure 7 plots observations for traders operating in control areas in red, and observations for farmers operating in areas exposed to the policy in green. As can be seen, most points are above the 45 degree lines, though there also seem to be occasions where the price at which traders (reportedly) bought maize is lower than the price at which they sold. While some of these traders may have made a loss, some if it will also be measurement error since it may be hard for traders to name a single average price over an entire season.

To deal with overplotting, we added contour plots with the same color coding to figure. For the control group, density is highest at points corresponding

Spillover/Indirect contracts



Control

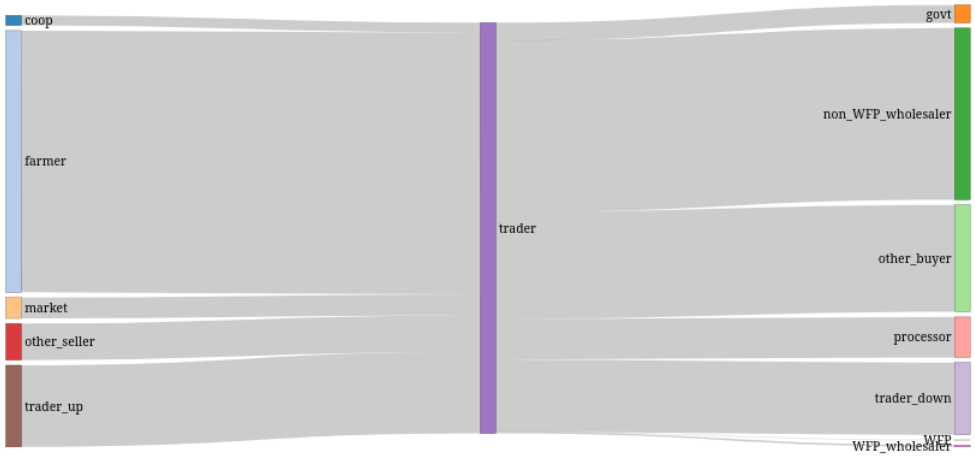


Figure 6: Commodity flows

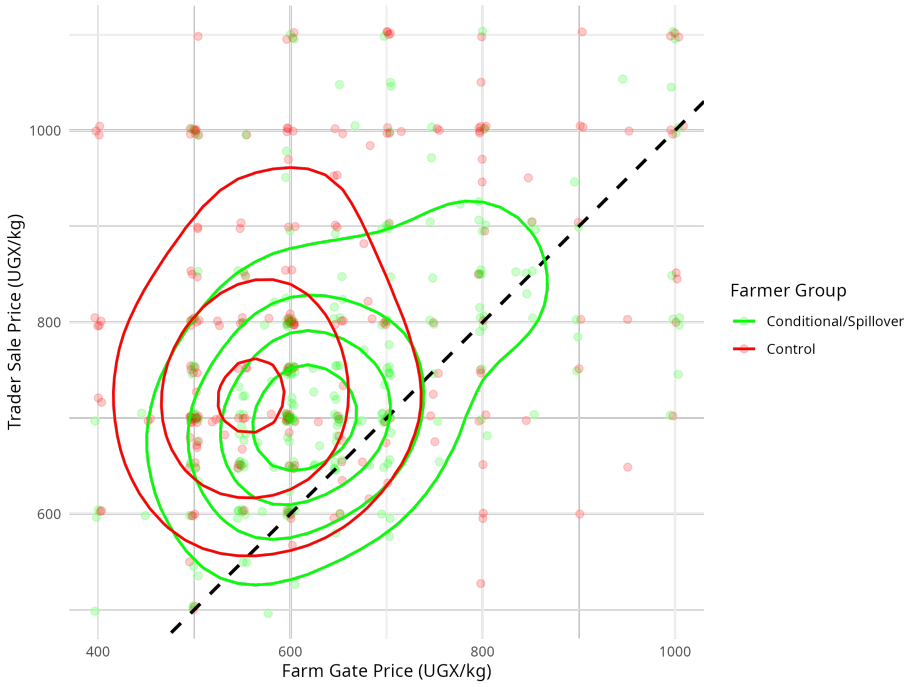


Figure 7: Price margin analysis using trader level data

to a farm gate price of about UGX550 per kilogram of maize and a sales price of about UGX725 per kilogram, leading to a trader margin of about UGX175 per kilogram of maize. For traders working in areas where the policy was implemented, density is highest to the southeast of the control density plot. In particular, in these areas traders pay about UGX625 per kilogram, while traders sell onward for about UGX700, leading to a trader margin of about UGX125 per kilogram. Note that compared to the control areas, farmers get more at the farmgate, while consumers are likely to pay less. This seems to suggest that value chains are more efficient in areas where WFP is procuring.

We can also combine data at the farmer level with data at the trader level to triangulate the findings above. Figure 8 shows that in areas where WFP was active with Indirect conditional contracting, intermediaries capture less of the rents than in control ares. For example, in the first season of 2023, farmers sold maize at about UGX800 per kg, while traders sold at about 875, implying a margin of about 10 percent. In the control areas, farmer sell at about 750, while traders sell at 900, implying a margin of 20 percent. We also see that the margin reduces with overall price levels. In the second season of 2023, farmers in the treatment areas sold at 650, while traders sold at 775, implying a 20 percent margin; in control areas the margin increase to 36 percent.

The increase in price may be a direct effect of increased prices and quantities

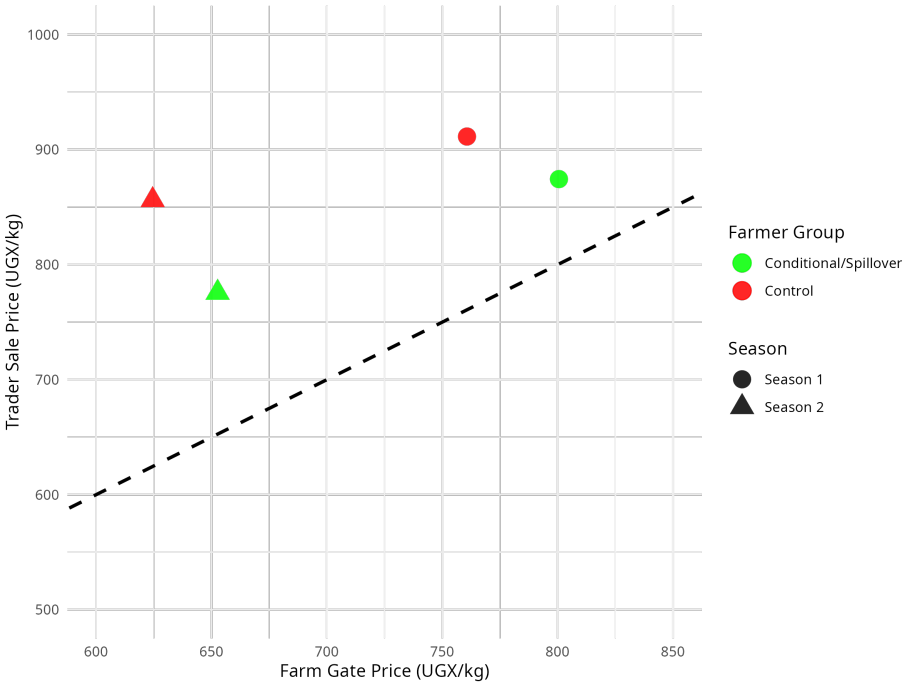


Figure 8: Price margin analysis combining farmer and trader level data

demanded by a significant and credible buyer. However, there are many other indirect pathways through which the policy may indirectly increase prices. One such indirect pathway would be that the entry of a large buyer leads to market entry by traders. We already established in section 5.1.1 that the policy seems positively related to competition. The increased competition among traders could then be responsible for (part of the) price increase at the farmer level.

To test if competition among traders mediates the impact of an intervention on the price received by farmers, we use structural equation modeling, which includes techniques like path analysis and mediation analysis. Mediation analysis helps in understanding how an independent variable (in this case, indirect conditional contracting) influences a dependent variable (price received by farmers) through a mediator variable (the level of competition proxied by the number of traders in the area).

Mediation analysis involves the joint estimation of two regression equations. First, the intervention is regressed on the mediator variable. In a second regression, two explanatory variables are used (the mediator and the intervention indicator) to explain the outcome (in our case the price farmers receive). This allows one to separate the total effect of the intervention into a direct effect (which is the effect of indirect conditional contacting on the farmgate price while controlling for trader entry) and an indirect effect (which is the effect of indirect contractin on trader entry multiplied by the effect of trader entry on farmgate prices while controlling for the indirect contracting).

We again perform such an analysis first using only trader level data. In particular, using farm gate prices that traders report to be paying to farmers, we find a total effect of the policy of UGX 91.12 that can be decomposed into a direct effect of 91.73 and a negligible mediated effect (-0.61), the latter being not statistically different from zero.

We repeat this analysis by combining trader level and farmer level data. To do so, we need to create a measure of competition at farmer level. We do this by calculating the average of the responses provided by the traders, and use as weights the inverse distance between the farmer and the trader. Running the analysis then at the farmer level gives us a total effect of UGX 54.58 that can be decomposed into a direct effect of UGX 26.69 and a mediated effect of UGX 27.89. In this case both direct and indirect effects are significantly different from zero. These findings suggest that the intervention not only directly increases the price received by farmers but also does so indirectly by enhancing competition among traders.

5.4 Seasonality

Most farmers typically sell most of their harvest immediately after harvesting. Over time, as stocks dwindle, less maize is brought to the market. During the leans season and especially immediately before the harvest of the subsequent season, more maize is bought than sold. These demand and supply patterns result in seasonal price movements in maize prices.

These cyclical price movements can be large, with prices often more than

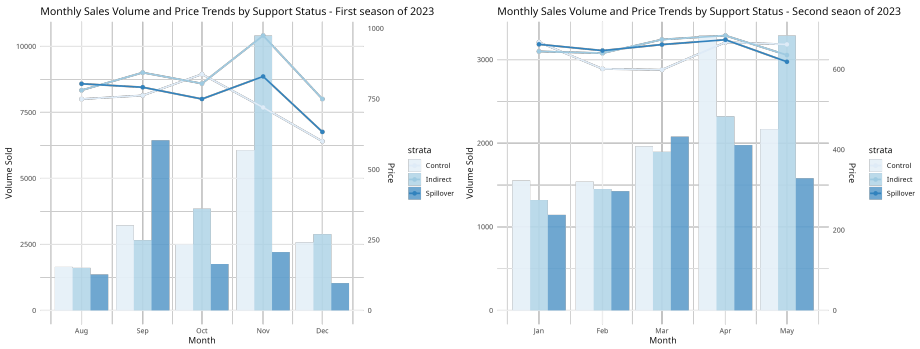


Figure 9: Seasonality in price and volumes

doubling over time. For poor farmers that do not have the capacity to engage in inter-temporal arbitrage, this can lead to so called sell-low buy high patterns, where farmers sell maize at low prices only to buy back similar amounts of maize later in the season at significantly high prices (Burke, Bergquist, and Miguel, 2019). Van Campenhout, Lecoutere, and D'Exelle (2015b) argue that farmers face a double whammy as in addition to the price effects, traders are also likely to pass transaction costs to the farmers.

An important question therefore is whether the indirect conditional contracting modality increases of reduces seasonality in prices. If WFP purchases target low prices and writes out tenders immediately post harvest (and potentially distributes food aid during the lean season), its activities could have counter cyclical effects. However, if WFP faces delays in procurement due to administrative reasons, or if traders speculate on WFPs purchase, price variation could increase.

Figure 9 uses farmer level data to look at seasonality in volumes entering the market and prices. Interestingly, we do not find that quantities sold are highest immediately after harvest. Especially in the second season, farmers seem to hold on to their maize until April or May. There is some suggestive evidence supporting the hypothesis that farmers in the indirect conditional contacting group hold on longer to their maize. For instance, in the first season of 2023, volumes marketed in this group rise steadily to peak in November. in the second season, the peak is May. Patterns are less clear for the other groups. In the fist season, there is peak among spillover farmers early on in September. In the second season, there is an unusual uptick in sales in April in the control group.

Prices seem to remain fairly stable immediately after harvest. There is a notable increase in prices in the first season of 2023 in November, which is also the month when sales peak in the Indirect conditional contract group. Interestingly, the increase in prices is highest in the group of farmers that are linked to WFP buyers, and lowest in the control group. Overall, and in both seasons, prices reported by farmers that are directly linked to WFP generally report higher prices. This seems to suggest that WFP purchases indeed led to

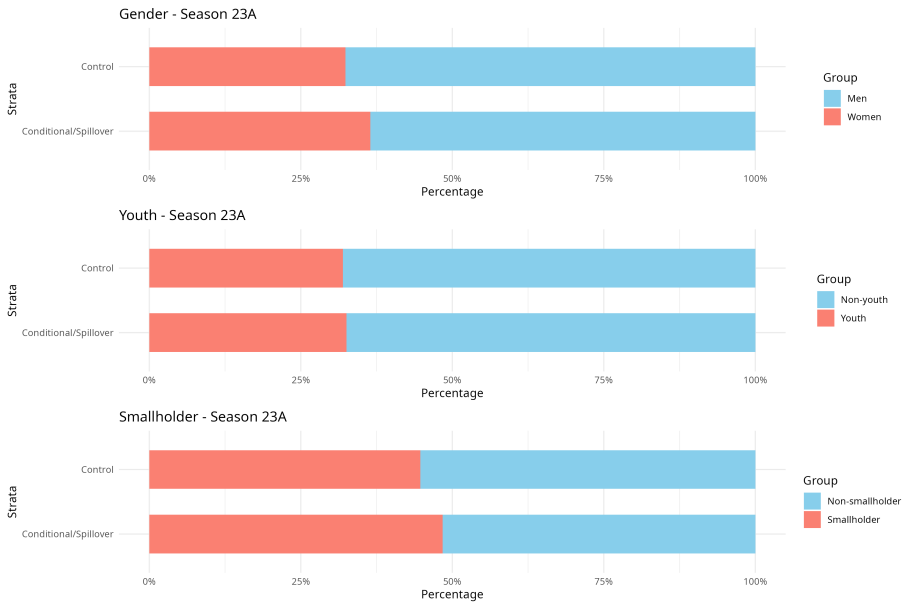


Figure 10: Gender, age and scale of farmer bought from

some degree of price inflation.

5.5 Inclusivity

An important concern raised by WFP is whether the benefits arising from indirect conditional contracts reach vulnerable groups, such as women and youth. Additionally, one of the core objectives of the project is to ensure that smallholder farmers are able to benefit from WFP's procurement activities. In this section, we examine whether the impact of these contracts differs across groups, with a particular focus on farm-gate prices as the key outcome variable.

To assess inclusivity, we asked traders to estimate the proportion of their farmer-suppliers who are women, youth, and smallholders. As shown in Figure 10, approximately 30 percent of sellers are women, with a slightly higher share observed in areas where the policy is implemented. A similar share—around 30 percent—of sellers are classified as youth, with little variation between treated and comparison areas. Regarding smallholder farmers, traders report a notable difference: in areas where the policy is in place, nearly half of the sellers are smallholders, suggesting that the intervention may be enhancing participation among this target group.

We now turn to pricing outcomes across different farmer groups, using data on individual sales from the first season of 2023. To assess potential disparities, we analyze transaction-level prices through simple regressions that examine the interaction between farmer characteristics—such as gender, age, and farm

size—and treatment status. The results reveal a significant overall effect of the policy on the prices farmers receive. However, we find no evidence of differential effects by gender or age, suggesting that concerns about the policy disproportionately benefiting male farmers or excluding youth may be unfounded. On the other hand, the analysis indicates that the policy's core objective of improving outcomes for smallholder farmers has not yet been fully realized.

Table 3: Regression Results: Price Analysis

	Dependent variable:						
	Price						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
strataIndirect	43.733*		50.460		40.470		55.233*
	(22.966)		(34.108)		(27.025)		(30.209)
strataSpillover	35.254		51.593		39.746		51.824
	(24.053)		(34.392)		(28.881)		(34.547)
genderMale		0.217	15.252				
		(19.504)	(31.141)				
strataIndirect:genderMale			−11.656				
			(46.240)				
strataSpillover:genderMale			−32.022				
			(48.464)				
youth				26.421	27.900		
				(21.457)	(35.862)		
strataIndirect:youth					5.820		
					(51.693)		
strataSpillover:youth					−21.021		
					(52.994)		
small						−6.693	4.555
						(20.093)	(32.895)
strataIndirect:small							−27.019
							(48.359)
strataSpillover:small							−25.545
							(50.273)
Constant	760.711***	784.587***	752.091***	777.058***	753.874***	792.882***	763.376***
	(15.406)	(14.113)	(23.412)	(11.541)	(17.753)	(13.222)	(19.642)
Observations	636	636	636	636	636	612	612
R^2	0.006	0.00000	0.007	0.002	0.009	0.0002	0.008
Adjusted R^2	0.003	−0.002	−0.001	0.001	0.001	−0.001	−0.0001
Note:							*p<0.1; **p<0.05; ***p<0.01

6 Conclusion and Way Forward

This study set out to assess the impact of indirect conditional contracts implemented by the World Food Programme (WFP) in Uganda, with a specific focus on their role in transforming the maize value chain. Our analysis was guided by four core research questions: (1) What is the impact of the conditional contract on key outcomes—price realization, mount sold, household income and other welfare indicators—of actors along the value chain, especially for smallholder farmers and small maize traders? (2) Do conditional contracts create access to reliable markets and result in value chain transformation or upgrading? (3) Does the presence of a formal/institutional buyer in an area (e.g. a WFP-affiliated trader or contract scheme) indirectly improve outcomes for nearby smallholders and traders who are not directly contracted? (4) What are the challenges or barriers faced with respect to conditional contracts?

To answer these questions, we collected rich, stratified data from over 1,300 farmers and nearly 300 traders from six districts in Western and Central Uganda. Stratification was done conditional on how farmers and traders were likely to be exposed to the indirect conditional contract programme. In a first group, farmers that were connected to a WFP buyer are included. In a second group, we interviewed their neighbors. A third group was in a district where WFP was not active. For traders, we only differentiated between traders working in areas where WFP is active versus districts where they are not. We then attempt to learn about the impact by comparing the groups. We applied both descriptive and econometric techniques—including fixed effects models and mediation analysis—to disentangle the effects of the procurement policy from other factors.

We find that farmers in areas exposed to the policy were significantly more likely to participate in markets and to sell larger quantities of maize. They also cultivated larger areas of maize and adopted improved seed varieties and, to a lesser extent, fertilizer. The policy also led to higher prices for farmers and lower margins for traders, suggesting a more efficient value chain. Structural equation modeling revealed that part of the price increase was directly due to the policy, while part was mediated through enhanced competition among traders.

Traders in policy-affected areas handled significantly more maize, indicating improved aggregation and possibly greater investments in storage and transport infrastructure. They also sourced more from cooperatives and engaged more frequently with WFP, signaling that the policy may be reinforcing more formal and traceable sourcing arrangements.

The policy may also influence price seasonality, with some evidence that farmers in treated areas delay sales to benefit from higher prices later in the season. This has implications for both farmer incomes and consumer access. Despite WFP's commitment to inclusivity, the policy did not result in significantly different price effects across gender or age groups. There was also no different impact on small farmers.

Next steps in this research involves agreeing on a limited number of outcomes that we/WFP feel important and then apply more formal analysis to be able to assign causality to the treatment and to also tie associations more the the

conditional contacting (instead of conflating impact with simply the presence of WFP). In particular, we propose:

- run regression analysis with controls, starting with controls for north and south.
- dropping the control and treating the spillover farmers as controls for treated farmers. This is more suggestive of the impact of conditional contracts as in both cases now farmers are exposed to the significant buyer. Note that we can block on pairs to get rid of pair all characteristics that would be the same for both of these farmers (like distance to trader etc)
- repeat analysis for subgroups of farmers that are actually selling to WFP as the treatment variable. If the effect becomes bigger, that would indicate any effect really comes from the policy. This can also be done for traders.
- If we link farmer and trader data, we have a many-to-many network. Can we do something with this? Eg for each trader look at differences between connected farmers and for each farmer look at difference between connected traders? Like in our gender paper?

References

Ashour, M., D. O. Gilligan, J. B. Hoel, and N. I. Karachiwalla. 2019. "Do beliefs about herbicide quality correspond with actual quality in local markets? Evidence from Uganda." *The Journal of Development Studies* 55 (6): 1285–1306.

Barrett, C. B. 2008a. "Smallholder market participation: Concepts and evidence from eastern and southern Africa." *Food Policy* 33 (4): 299–317.

———. 2008b. "Smallholder market participation: Concepts and evidence from eastern and southern Africa q." *Food Policy* 33: 299–317.

Barriga, A. and N. Fiala. 2020. "The supply chain for seed in Uganda: Where does it go wrong?" *World Development* 130: 104928.

Bold, T., K. C. Kaizzi, J. Svensson, and D. Yanagizawa-Drott. 2017. "Lemon technologies and adoption: measurement, theory and evidence from agricultural markets in Uganda." *The Quarterly Journal of Economics* 132 (3): 1055–1100.

Burke, M., L. F. Bergquist, and E. Miguel. 2019. "Sell low and buy high: arbitrage and local price effects in Kenyan markets." *The Quarterly Journal of Economics* 134 (2): 785–842.

Davies, K. N. and N. Menage. 2010. "Connecting Farmers to Markets: Insights from the Purchase for Progress Initiative." In "Revolution: From Food Aid to Food Assistance," , edited by W. Omamo, U. Gentilini, and S. Sandstrom. World Food Programme.

Erenstein, O., M. Jaleta, K. Sonder, K. Mottaleb, and B. M. Prasanna. 2022. "Global maize production, consumption and trade: trends and R&D implications." *Food security* 14 (5): 1295–1319.

Fermont, A. and T. Benson. 2011. "Estimating yield of food crops grown by smallholder farmers: A review in the Uganda context." .

Global Compact on Refugees. 2018. "Comprehensive Refugee Response Model in Uganda: Case Study." Accessed: 2025-03-13.

Gourlay, S., T. Kilic, and D. B. Lobell. 2019. "A new spin on an old debate: Errors in farmer-reported production and their implications for inverse scale-Productivity relationship in Uganda." *Journal of Development Economics* 141: 102376.

Guloba, M. M., S. Mbowa, F. Nakazi, D. Mather, and E. Bryan. 2023. "Sugarcane production and food security in Uganda."

Leao, R., G. Ferrera, B. Zhao, Food, and A. O. (FAO). 2021. "Leveraging Food Procurement to Achieve Developmental Goals: World Food Programme's Practices and Lessons Learned." In "Public Food Procurement for Sustainable Food Systems and Healthy Diets," FAO; Bioversity International.

Lentz, E. and J. Upton. 2016. "Benefits to smallholders? Evaluating the World Food Programme's Purchase for Progress pilot." *Global Food Security* 11: 54–63.

Mather, D., D. Boughton, and T. Jayne. 2013. "Explaining smallholder maize marketing in southern and eastern Africa: The roles of market access, technology and household resource endowments." *Food Policy* 43: 248–266.

McGuire, S. and L. Sperling. 2016. "Seed systems smallholder farmers use." *Food security* 8 (1): 179–195.

Miehe, C., R. Sparrow, D. Spielman, and B. Van Campenhout. 2023. *The (perceived) quality of agricultural technology and its adoption: Experimental evidence from Uganda*. Intl Food Policy Res Inst.

Sitko, N. J. and T. Jayne. 2014. "Exploitative briefcase businessmen, parasites, and other myths and legends: assembly traders and the performance of maize markets in eastern and southern Africa." *World development* 54: 56–67.

Upton, J. and E. Hill. 2011. *Local and Regional Procurement of Food Aid in Uganda: The Experience of Maize Traders*. Tech. rep., Working Paper, March 2011. http://dyson. cornell. edu/faculty_sites/cbb2 ....

Van Campenhout, B., E. Lecoutere, and B. D'Exelle. 2015a. "Inter-temporal and spatial price dispersion patterns and the well-being of maize producers in Southern Tanzania." *Journal of African Economies* 24 (2): 230–253.

———. 2015b. "Inter-Temporal and Spatial Price Dispersion Patterns and the Well-Being of Maize Producers in Southern Tanzania." *Journal of African Economies* 24 (2): 230–253.

Van Campenhout, B., B. Minten, and J. F. Swinnen. 2021. "Leading the way–foreign direct investment and dairy value chain upgrading in Uganda." *Agricultural Economics* 52 (4): 607–631.

WFP. 2023. "WFP 2023 annual report."

World Food Programme. 2006. "Food Procurement in Developing Countries." Accessed: 2025-03-13.

———. 2015. "Purchase for Progress (P4P): Reflections on the Pilot." Accessed: 2025-03-13.

———. 2019. "WFP Uganda's Agricultural Market Support Programme - 2019." Accessed: 2025-03-13.

World Food Programme (WFP). 2024. "Eastern Africa, Evaluation of Local and Regional Food Procurement Pilot Programmes 2021-2023." Accessed: 2024-03-13.