Market participation of smallholder farmers in Malawi: A baseline report

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Abstract

Smallholder farmers in low and middle income countries often sell the bulk of their marketable surplus immediately after the harvest, when prices are at their lowest. We pilot several interventions to investigate if this is due to poor planning. In one treatment arm we test if expenditure planning is a main determinant of sub-optimal marketing behaviour, while in a second treatment we look at planning on the income side and ask farmers to commit to timing and sales prices. In this report, we summarize the baseline data that was collected as part of this study. The study focuses on 3 three semi-commerical crops: maize, soybean and groundnuts.

1 Introduction

Smallholder farmers in developing countries generally produce for own consumption. However, most farmers also need cash for a variety of non-food expenditures. Some farmers therefore produce more than what they expect they will need and sell a surplus. Other farmers cultivate cash crops. Therefore, most farmers are not strictly subsistence farmers, but also participate in the market, not only as consumers, but also as producers.

When farmers interact with markets, they are also exposed to price risk. In weakly integrated markets where spatial arbitrage is slow and transaction costs to move commodities from low price regions to high price areas are high, prices often exhibit significant variation both in time and space (Van Campenhout, 2007). This generally also means that prices exhibit significant seasonality, with price at their lowest immediately after harvest as supply booms, and prices then gradually increasing until reaching a peak just before the next harvest (Gilbert, Christiaensen, and Kaminski, 2017).

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These predictable and recurrent price movements suggests that farmers have an incentive to delay sales of at least part of their marketable surplus until prices recover from their post harvest slump. In practice, however, we often see that farmers sell all of their crop immediately after harvest when prices are at their lowest. Often, later in the season, farmers run out of stocks and are forced to turn to the market again, now buying back the same commodities at much higher prices. This has sometimes been referred to as the "sell low buy high" phenomenon (Stephens and Barrett, 2011).

Various reasons have been suggested to explain this behaviour. The most obvious reason would be that farmers simply need the money. For instance Burke, Bergquist, and Miguel (2018) report on a field experiment in Kenya and suggest that credit market imperfections limit farmers' abilities to move grain intertemporally. Dillon (2021) uses the fact that in Malawi, primary school began 3 months earlier in 2010 than in 2009, and notes that this prompted households with children to sell maize when prices are particularly low. To identify the impacts of liquidity during the lean season, (Fink, Jack, and Masiye, 2020) offered subsidized loans in randomly selected villages in rural Zambia and conclude that liquidity constraints contribute to inequality in rural economies. Another often heard reason is that farmers may simply lack sufficient safe storage space for their crops, making it too expensive to store for longer periods of time. If storage is the main reason why farmers do not engage in intertemporal arbitrage, then providing storage technology should delay sales. Omotilewa et al. (2018) indeed find that Ugandan maize farmers that received a low cost, simple, and effective technology for low resource farmers to help them preserve their dry crops after harvest with minimal losses due to storage insects (so called PICS bags) stored maize for a longer period. However, in a study comparing the importance of liquidity constraints and storage limitations, Channa et al. (2022) finds that only the former contains farmers from selling later at higher prices in Tanzania.

While the above factors will be binding for some farmers, many questions remain unanswered. For example, if liquidity constraints are the main problem, it is unclear why farmers generally sell everything at once, instead of just enough to cover the most urgent expenses. If storage is a problem, it seems strange strange that not more farmers form groups to rent storage space, or why in Malawi the Agricultural Commodity Exchange faces difficulties filling their warehouses.

In an ongoing study, we test two behavioural explanations related to the inability of farmers to if this is due to poor planning. In one treatment arm we test if expenditure planning is a main determinant of sub-optimal marketing behaviour, while in a second treatment we look at planning on the income side and ask farmers to commit to timing and sales prices. In this report, we summarize the baseline data that was collected as part of this study.

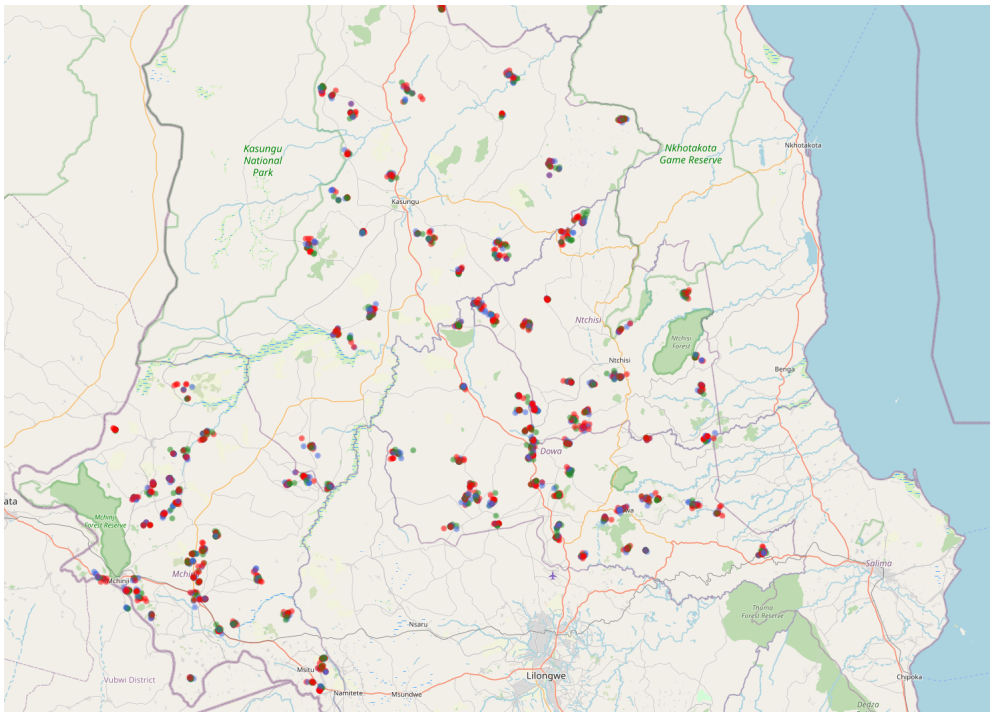

Figure 1: map of study area with sampled villages

2 Data collection

Data collection took place between around the end of May and beginning of June 2022. Using tablet computers and Open Data Kit software, 31 enumerators interviewed 3534 farmers that were sampled from four districts in the Central and Northern Regions of Malawi (Kasungu, Ntchisi, Dowa and Mchinji).

To get a nationally representative sampling frame of the smallholders farmers population Malawi, we rely on the list created by the Ministry of Agriculture for their Agricultural Input Programme (AIP). The AIP only targets smallholder farmers in the villages who mostly registered with the village chiefs. We used a two-stage sampling procedure where we first sampled villages with the likelihood of a village being selected being proportionate to the number of people that live in this village (such that larger villages are more likely to end up in the sample). We then randomly sampled 31 households in each of the sampled villages. Figure 1 gives a sense of coverage and dispersion of the interviewed households.

The focus of the study is on market participation and so the targeted study population are farmers that are likely to engage with markets. As such, we included qualifier questions in our sample, where we asked farmers if they were planning to sell maize, soybean or groundnuts during the 2022 season. Restricting our study population to a particular sub-population has implications

for the interpretation of the results. For instance, we will see later that we find relatively high proportions of households reporting to sell to the market as compared to what is typically found in other studies (Barrett, 2010). As such, the study population, semi-subsistence smallholder farmers, needs to be kept in mind when interpreting results, as they may be different from for example pure subsistence farmers.

3 Farmer characteristics

Table 1 presents the summary statistics of the households and household heads that we surveyed. Eighty percent (80%) of the households are headed by men. The average household is headed by a 43 year old with six years of schooling (primary level). The typical household has five members on average, living in houses of three rooms. Four in every 10 households have their main houses roofed with corrugated iron sheets. We find that the average distance of the households to the nearest all weather road and nearest market is 1km and 4km respectively.

We also collected information on the households' access to transport facilities or assets (either through ownership or hire). Results in Table 1 show that households mostly have access to a bicycle (72% of respondents) and ox-carts (60% of the respondents). Ox-carts are particularly important for transportation of harvest from the farms to the market. Households also own livestock assets; the most common being chicken, goats and pigs.

4 Prices

4.1 Price expectations

As part of baseline data collection, we asked questions about price expectations in the coming year. In particular, we asked what price they expect a farmer to receive for selling maize at the market nearest here, in early September of 2022 (the beginning of the school year). This was asked for maize, soybean and for groundnuts in appropriate units (kg for maize and soybean, debbe for groundnuts). We repeated this question, but for late December of 2022 (at the new year).

Figure 2 shows price expectations for the three crops included in the study (here expressed per kg of the crop). As can be seen, farmers expect that prices increase over time. The increase of the expected price over the course of only a few months is substantial. For example, for maize, the increase in median price is 36 percent. For soybean and groundnuts, this is 25 percent and 40 percent respectively.

In addition to asking about prices of the three crops, we also asked about prices from a few other items. For instance, we asked about the price of a healthy 2-year old female goat. Interestingly, and against our expectations, we also found that the price of a goat increased substantially over time. While a

Table 1: Household characteristics

	Mean	Std dev	N
	Household head		
Household head is male	0.791	0.407	3,534
Age of household head (years)	43.426	14.831	3,414
Years of schooling of household head	6.329	3.489	3,427
Roof of main building is grass thatch	0.609	0.488	3,534
	Household characteristics		
Roof of main building is corrugated iron	0.39	0.488	3,534
Household size (number of people)	5.043	1.992	3,530
Number of rooms in the house	3.202	1.178	3,534
Distance (kms) to nearest all weather road	1.308	3.433	3,346
Distance (kms) to nearest market	4.107	4.78	3,243
	Transport		
Household has access to bicycle	0.719	0.45	3,534
Household has access to saloon car	0.218	0.413	3,534
Household has access to pick-up or lorry access	0.221	0.415	3,534
Household has access to ox-cart	0.595	0.491	3,534
Household owns a motorbike	0.11	0.313	3,534
	Livestock assets		
Number of bulls/oxen/steers owned by household	0.123	0.653	3,533
Number of cows or heifers owned by household	0.128	0.799	3,532
Number of calves owned by household	0.053	0.495	3,533
Number of pigs owned by household	0.708	1.943	3,534
Number of goats owned by household	1.241	2.569	3,533
Number of sheep owned by household	0.055	0.519	3,531
Number of chicken owned by household	4.743	6.509	3,532
Number of ducks owned by household	0.282	1.501	3,533

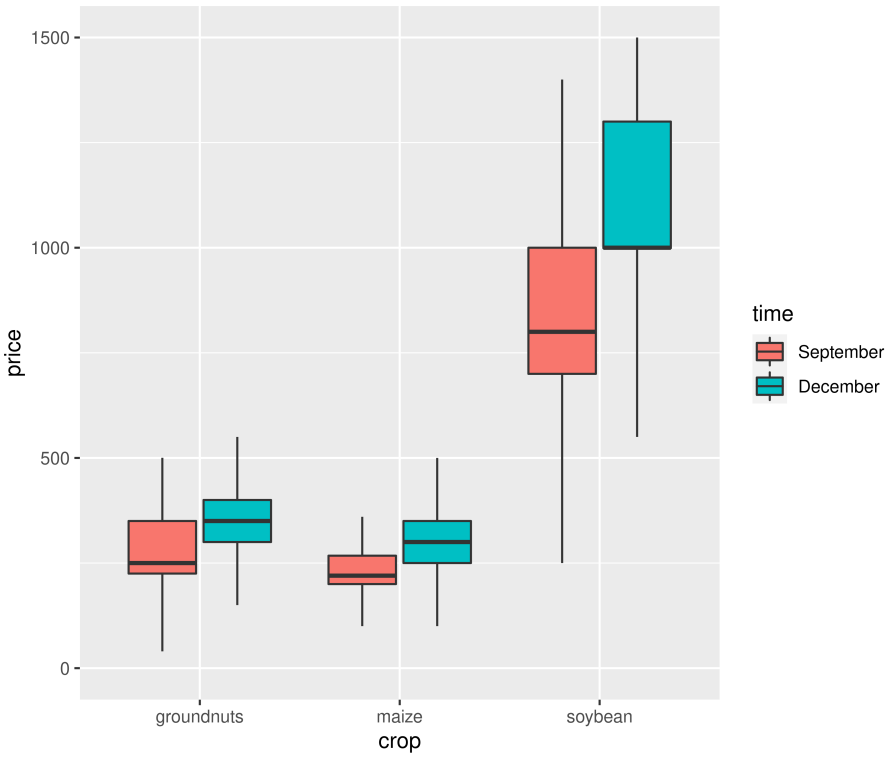

Figure 2: Price expectations for 2022

goat was expected to be sold at 25000 Kwatcha in early September, it increased to 30000 Kwatcha towards the end of the year. We further asked farmers to quote expected prices for fertilizer at the end of December, an important input for smallholder maize farmers used at that time. We also asked what they expect to pay for hiring labour to prepare 1 acres of farmland for maize production in September, which is when farmers prepare fields. Median value for the former is 60000 kwatcha, and 20000 kwatcha for the latter.

The fact that farmers do seem to expect a considerable increase in prices over time suggests that farmers are at least aware of the fact that they could make more money by holding on to stocks longer.

At the time of the survey, traders had already started buying soy bean and prices were attractive. As a result we found that many farmers already sold (part of their) soy bean. In particular, of those farmers that already started harvesting soybean, 76 percent indicated that already made at least one sales transaction. We further found that 10 percent of those that already harvest sold more than 80 percent of what they had harvested. For those who already sold at least once, the median price they received was 600 Kwatcha, which is substantially lower then expected prices in September and January (Figure 2). For those who sold virtually everything already, the median price they got was also 600 Kwatcha.

4.2 Price seasonality in the previous season

The top panel of Figure 3 shows the evolution of the median prices that farmers received for their crops in the past. In particular, we asked farmers to report if they sold any of the three crops under consideration. If they reported sales, we asked how many separate transactions occurred and for each transaction, we recorded details such as the amount sold and price received.[1]

The middle panel of Figure 3 shows price indices with as base the month of May 2021. This is the month following the harvest for most of the crops (although groundnuts is harvested somewhat later) and it also happens to be around the time the survey happened in 2022. The figure show that over the course of the year, prices for all commodities have been increasing. After only 4 months, prices of groundnuts already increased by 50 percent. After 6 months, in November 2021, median prices of all three crops were about 50 percent higher than immediately after the harvest in May. By December, prices of soybean had more than doubled and were still on the rise.

The bottom panel shows price indices with as base the month of September 2021 and is included to facilitate comparison with the price expectations presented in above. It shows that between September 2021 and January 2022, median soybean prices increased by 100 percent. However, as seen above, farmers expect a price increase in 2022 of only 25 percent. For groundnuts, prices increased by 33 percent, while expectations are 40 percent. For maize, prices

[1] Prices for groundnuts and maize are in kilograms. For soybean, they are per 250 gram to keep the prices on a comparable scales.

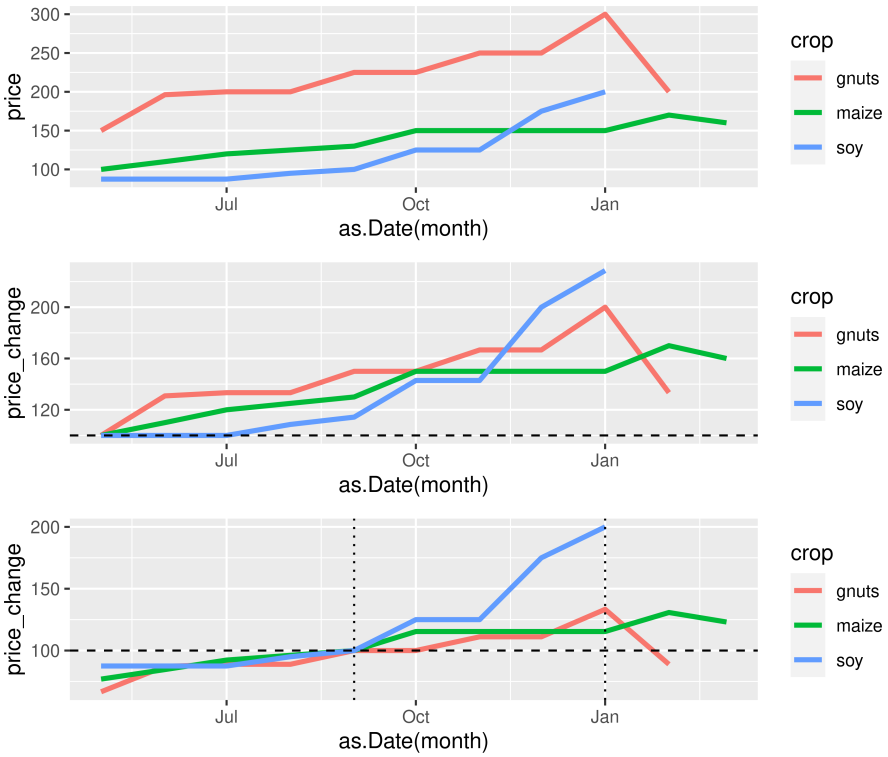

Figure 3: Evolution of prices received by farmers in 2021-2022

remained fairly stable, increasing only 15 percent. Farmers expect an increase of 36 percent for maize.

5 Crop production

The average household produced 1328 kg of maize, 152 kg of groundnuts and 292 kg of soybean in the 2021 agricultural season. Over an entire year and aggregated over all farmers in our sample, this amounts to 230 tons of groundnuts, 600 tons of soy and almost 4500 tons of maize. The top panel of Figure 4 shows how production is distributed over the different months. Most soy is harvested in April and May. Maize harvesting starts in April but most harvest takes place in May and June. Groundnuts is harvested last.

The graph shows that in quantities, maize is a very important commodity. However, the value-to-weight ratio of these crops differs substantially, and so to get a different perspective of the importance of the three crops, we multiply quantities with prices to get an idea of the value of production. To do so, we simply multiply quantities with the average price of the crop received in 2021.

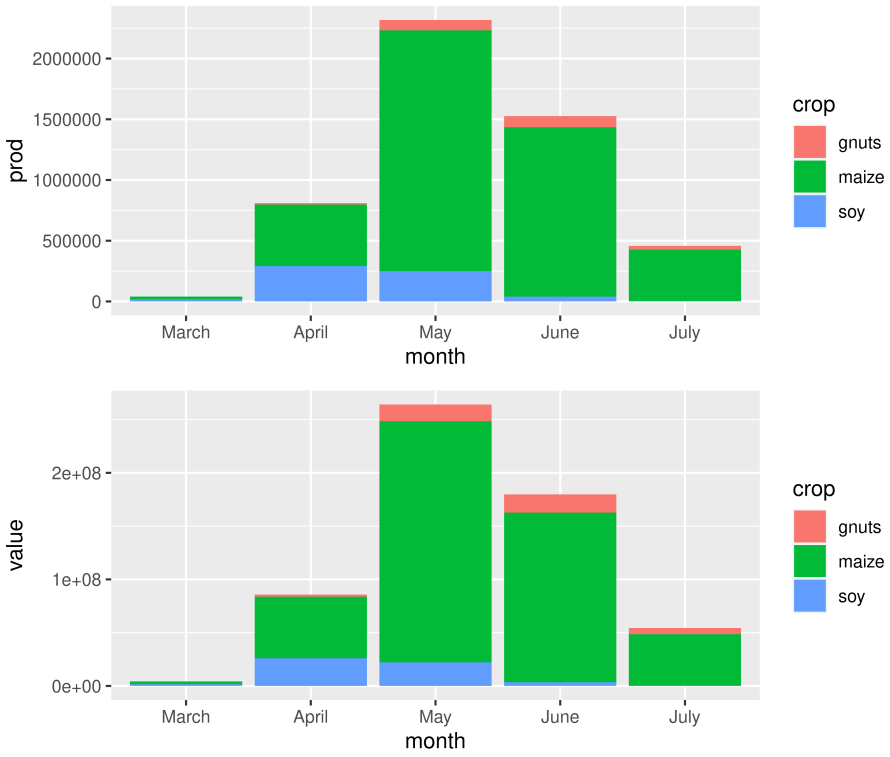

Figure 4: Crop production in 2021

Results are in the bottom panel of Figure 4. We see that groundnuts become more important, while the share contributed by soy bean becomes smaller. Note that the value of harvest is a rather theoretical concept. Actual income of the household will depend on how much of this is sold, and especially, when it was sold given potentially large seasonality in prices. The next sections look into these aspects of smallholder farmer behaviour.

We also collected information on production in 2022. As the survey took place around the end of May, maize and especially groundnuts were often still in the field. However, we also asked farmers to give an estimate of what they expect to get from fields that still needed to be harvested. Aggregating over all households in our sample, we find total production to be about 310 tons of groundnuts, 770 tons of soy and 4000 tons of maize. Results broken down by crops are in the top panel of Figure 5. We also express production in 2022 in value terms in the bottom panel. To do so, we use current prices, which are substantially higher than prices reported last year during the same period.

The figure reflects the fact that rains started late in 2022, and so most of the maize and groundnuts still needed to be harvested in June. Soy sells currently at more than 600 kwatcha per kg, which is reflected in a much larger important

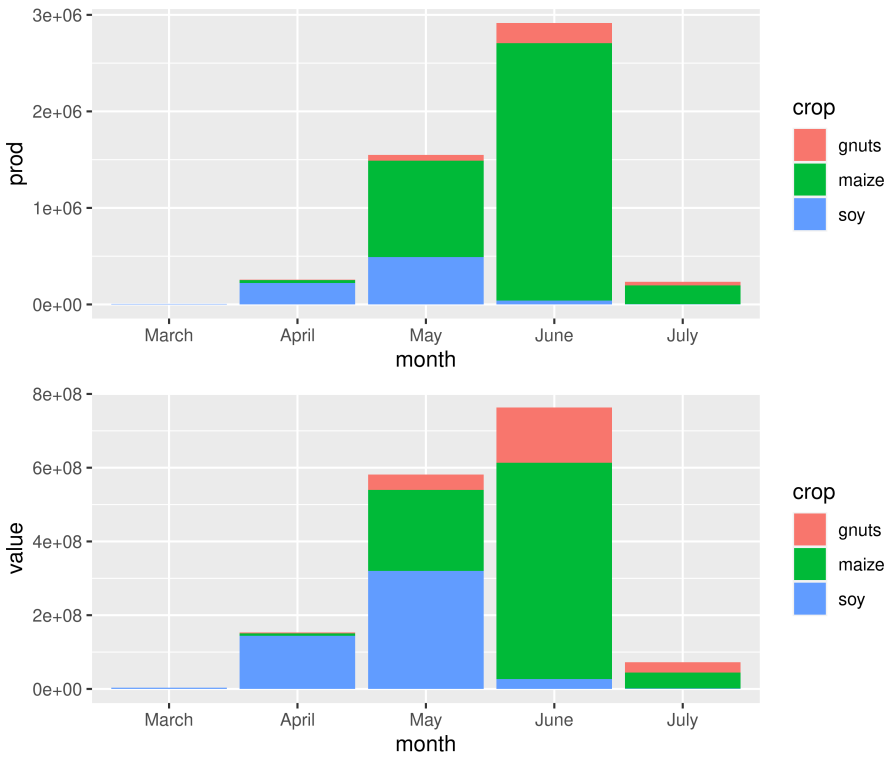

Figure 5: (Expected) crop production in 2022

in total value. However, also groundnuts and maize prizes are multiples of last year, resulting in much larger overall values.

6 Smallholder market participation

We find reasonable market participation by the farmers in our sample for the three crops. For instance, of the 3534 farmers interviewed, we find that 82 percent reported at least one sales transaction. But there are also signs of sub-optimal sales behaviour. For instance, in the face of uncertainty of price behavior in both directions, it seems farmers often sell everything in one go: of all the farmers that reported to report market interactions, 37 percent reports only a single transaction.

Table 2 provides detailed information for each crop separately. We see that of the 3452 farmers that reported to have grown maize in 2021, half also reported that they sold at least part of this. Soybean is more market oriented. Here, from the 2106 farmers that reported cultivating soy bean in 2021, almost 90 percent reported that they sold soy during at least one transaction. We also see large shares of households that report selling a paricular crop only reported a single transaction. This seems to be especially the case for soybean, where more than 8 out of 10 households report to have sold the entire marketable surplus in one go.

The third column in Table 2 provides a measure of early sales. We have defined early here as withing three months from the harvest date of the crop. We find that 45 percent of households report at least one maize sale transaction with the first three months post harvest (when prices are generally still low - see below). Postponing sales to get a higher price seems to be even less common for soybean. Here, again 8 out of 10 households reported at least on transaction with three months from harvest.[2]

In the last column, we report the share of households that report a single transaction and this transaction happened within three months after the harvest. We see that 2 out of three households sell soy in a single transaction when prices are still low.

Smallholder farmers dispose of their crops though four channels. They can sell directly to neighbors, friends or relatives, often within the same village. They can also choose to take their product to a market in their proximity. Furthermore, in villages, there are usually some small traders who aggregate commodities for further sale to larger traders. Finally, there are the itinerant traders from outside of the village that visit farmers and buy at the farm gate.[3]

Table 3 provides some summary statistics on crop disposal,

[2] If we look at early sales at the level of the individual transactions before aggregating at the household level, we find that: 35 percent of the maize transactions happened within the first three months post harvest; 57 percent of the groundnut transactions happened within the first three months post harvest; and 80 percent of the soybean transactions happened within the first three months post harvest.

[3] There may be other destinations for crops, such as direct sales to schools or prisons. However, the four destinations we consider are by far the predominant ones.

Table 2: Market participation by crop

	sold at least once	sold only once	sold immediately post-harvest	single transaction immediately post harves
maize	50	62	45	22
gnuts	70	78	63	42
soybean	89	84	85	67

note: sold is percentage of farmers who reported growing the crop, other measures are percentage of households who reported selling the crop. Sold immediately post harvest is the share of households that made at least one transaction in the first three months post harvest.

Table 3: Crop disposal

	maize		soybean		groundnuts	
	percent	price	percent	price	percent	price
neighbors	9	160	2	456	5	210
market	20	144	18	397	7	229
aggregator	28	138	29	371	31	211
trader	42	142	51	376	56	220

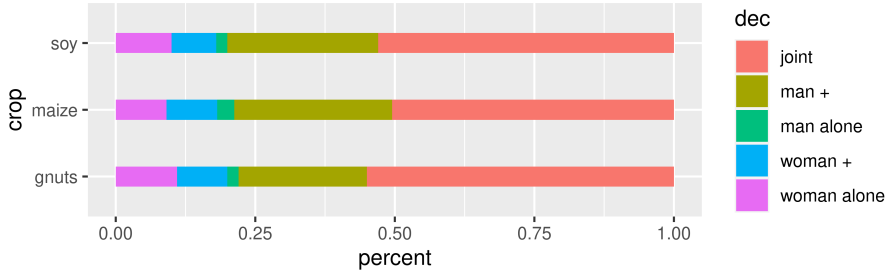

Figure 6: Who decided to sell?

The table also shows that selling to the market is generally the most profitable. However, when farmers directly sell to markets they can get a higher price, but also must incur a transport cost (Fafchamps and Hill, 2005). The second most profitable option is selling to middlemen at the farm gate. Selling to neighbors is more profitable for maize and soybean, but not for groundnuts.

We further asked who made the decision with respect sales. Gender patterns in decision making related to agriculture, and marketing of crops in particular, has been studied extensively in the context of women empowerment in agriculture (Alkire et al., 2013). Households are viewed as consisting of different individuals whose preferences do not necessarily align, and norms and customs may result in some crops or activities being more in the domain of one of the genders (Peterman et al., 2011). However, recently, the focus on non-cooperation and bargaining has shifted back, and joint ownership and decision making has become the focus of research again, often through the lens of common pool resources management (Doss and Quisumbing, 2020; Doss and Meinzen-Dick, 2015).

Results for gendered decision making are summarized in Figure 6. Categories included instances where 1) the woman decided alone without consulting anyone else in the household, 2) the woman decided alone but after consulting the husband and/or others in the household, 3) the man decided alone without consulting anyone else in the household, 4) the man decided alone but after consulting the wife and/or others in the household, 5) it was a joint decision.

We see that husband an wife generally take the decision to sell jointly. Men also often sell alone, but after consulting with the wife. Men almost never sell unilaterally, while women do. There is not a lot of difference between the crops, but one could argue that maize is more a male crop and groundnuts is more in the women domain.

7 Income from cash cropping

In this section we look at It seems strange that, even though prices go up, this is not reflected in median revenue.

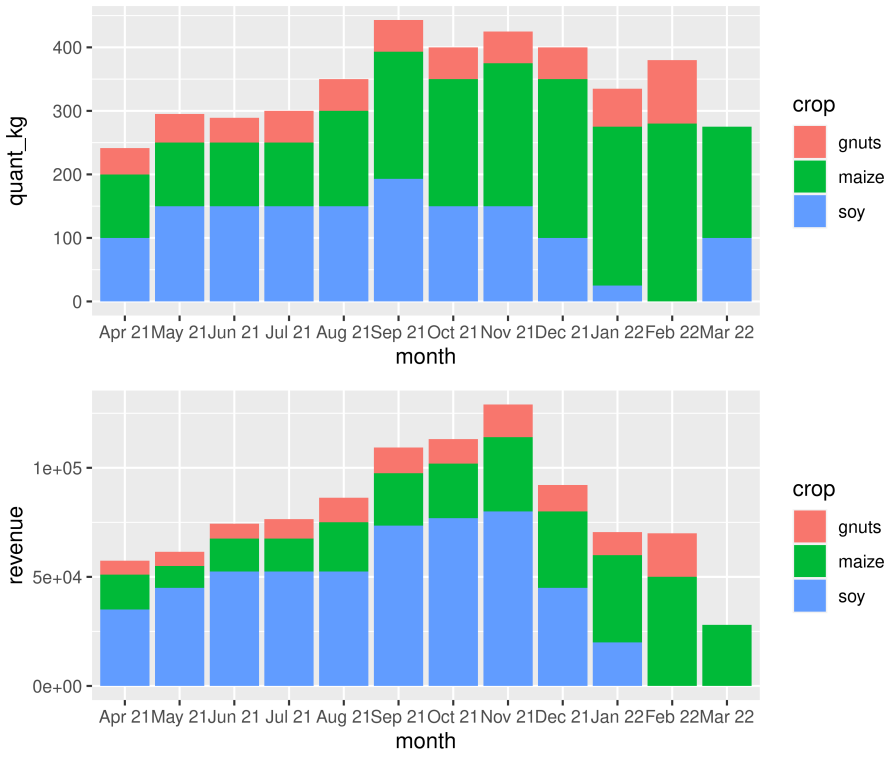

Figure 7: Revenue

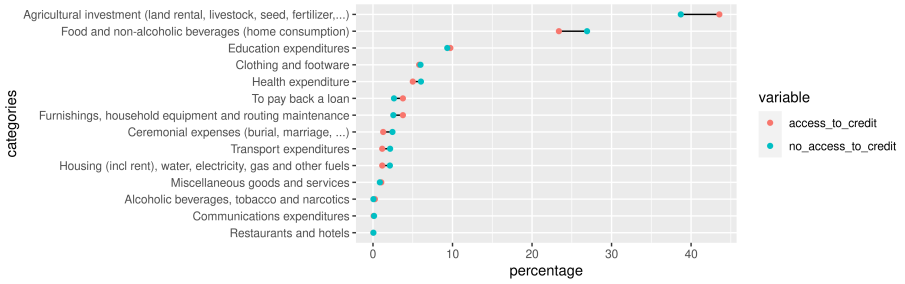

Figure 8: Use of proceeds of sales

For each transaction, we also asked what the proceeds of each transaction were mainly used for. Results are summarized in Figure 8

8 Anchoring

We now investigate the relationship between price expectations and prices received in the past. We first relate the average price that the farmer received in the previous season to price expectations in the next season using OLS models. To enable comparisons across crops, we use natural logarithms of both expected prices and prices received in the past, such that results can be interpreted as elasticities.

Table 4 starts by correlating overall price expectations (defined as simple average over expected price in September and December) to the average price that the farmer reported to have received over the preceding season. We see that there is a significant correlation between prices received in the past and price expectations for maize and for groundnuts, but not for soybean. For example the first column of Table 4 shows that farmers that sold at double the price (100 percent) than other farmers report expected prices that are about 10 percent higher than what other farmers expect. The second column shows that the elasticity is almost double for groundnuts. We do not find that price expectations for soybean are significantly correlated with average price expectations in the next season.

The table also shows correlation at prices at particular points in time in the future (instead of simple averages). For maize, the relationship between past prices and expected prices seems stable over time: farmers that received higher prices in the past expect higher prices in both September and December and the elasticity is the same. For groundnuts, a change in the average price received in the previous season is correlated to a larger price increase in the expected price in September than in December. The independence of price expectations and past prices of soybean is confirmed.

Table 4: Correlation with average prices received in the past season

	pooled	maize	groundnuts	soybean
Average expected price	0.076***	0.099***	0.180***	0.008
	(0.014)	(0.023)	(0.026)	(0.017)
Expected price in September 2022	0.083***	0.104***	0.202***	0.010
	(0.015)	(0.024)	(0.027)	(0.018)
Expected price in December 2022	0.073***	0.100***	0.161***	0.010
	(0.015)	(0.025)	(0.026)	(0.018)
Number of observations	4622	1702	1078	1842

Note: Standard errors are clustered at the household level. *** denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

9 Conclusion

Farmers often sell within the first three months post harvest and sell the entire marketable surplus in one single transaction. This seems to be especially the case for soy bean, which is generally cultivated as a cash crop. Ironically, prices of soybean have more than doubled, but the largest price increase happened only from November onward, when most of the soybean farmers had already sold their marketable surplus. Provided that price movements of soybean follow a similar pattern in the future, soybean farmers can substantially increase their revenue by waiting longer before selling, or selling smaller qualities at different points in time.

We find that prices farmers that received higher prices in the previous season also expect higher prices in the next season. This is especially the case for groundnuts; for soybean, prices in the past are not correlated to prices in the future. Furthermore, we find that farmers that experienced a larger increase in prices over the previous season also expect prices to rise faster. This is especially the case if farmers experienced a price increase early in the season.

We find that prices received in the past are positively correlated to price expectations. If farmers are myopic about inflation, this will mean price expectations are biased downward. With average inflation at around 16 percent, it is likely that farmers prone to anchoring leave substantial amounts of money on the table.

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