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Does Food Aid Disrupt Local Food Market? Evidence from Rural Ethiopia

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Abstract:

This paper analyses empirically the impact of food aid on wheat production, sales and purchases in rural Ethiopia between 1994 and 2009. We distinguish between the impact at the intensive margin (on quantities) and at the extensive margin (on the very decision to produce or go to the market to buy or sell). The panel dimension allows us to deal with food aid selection. We find that the impact of food aid goes through the extensive margin while pure quantity effects, once controlled for market participation and production choice, are not significant. Food aid reduces the probability of being a producer albeit the size of the effect is small. It also increases the probability of being a seller and decreases the probability of being a buyer after 2004, the year when the rules of food aid allocation changed in Ethiopia. Other factors such as storage capacity, distance to the nearest market, and the frequency the market is held also matter in the decision to sell or buy.

Keywords:

Food Aid, Market Participation, Production, Extensive and Intensive Margin, Panel Tobit, Ethiopia

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1. Introduction

Among the many policies that aim at improving food security, food aid obviously stands as a direct and powerful instrument. However, its impact on agricultural production and on food sales and purchases is still unclear. Food aid could harm production by decreasing prices and inducing shifts from one crop to another (Schultz, 1960; Dorosh et al., 1995; Bezuneh et al., 1988). Empirical evidence is mixed; studies relying on aggregate data have found strong disincentive effects (Mann, 1967; Isenman and Singer, 1977), while work based on household surveys tend to find the opposite (Lavy, 1990; Lowder, 2004; Abdulai et al., 2005; Tadesse and Shively, 2009). Abdulai et al. (2005) show that once one controls properly for endogeneity of food aid allocation there is no empirical support for the hypothesis that food aid creates disincentive effects at the household or macro level. Furthermore, they find suggestive evidence of potential positive effects of food aid. Tadesse and Shively (2009) study the channel of a decrease in producer price in order to investigate the impact of food aid on domestic production. They find that above a given level of food aid shipment, food aid induces a change in the local prices and thus may affect the level of production.

There are three potential explanations for this lack of clear evidence. First, there is a selection issue, as food aid targets some households that are low in production and, hence, less reliant on markets. Second, there could be some reverse causality if aid is given to a household based on the current harvest. Third, most previous studies have looked at the impact of food aid at the intensive margin (that is, its impact on quantities) but not at the extensive margin, namely, how it determines whether a household will produce, sell or buy a given crop. The difference was first described theoretically by Khatkhate (1962). To our knowledge only one working paper from Yamano et al. (2000) looks at the impact of food aid on decisions concerning buying and selling through an income effect; however,

the paper does not take into account the endogeneity of aid.

In this paper we consider households as heterogeneous in how they participate in markets. A given household may be growing a crop for its own consumption only (and will be labeled "autarkic") or selling part of the yield (hence, a "seller"). It could also buy the crop on the market (a "buyer") or not produce or consume the crop at all ("non-involved"). Using a panel dataset on Ethiopia, a major aid recipient for many years,[1] we document these different types of households. We also observe that households change the type of market participation over time, a shift that might be correlated to their receiving aid. We look at the impact of food aid at the extensive margin (on the choice of the type of market participation) and at the intensive margin (on the quantities). We focus on wheat, which is the main crop distributed through aid and the third most widely cultivated crop in Ethiopia.[2]

We use the Ethiopian Rural Household Survey (ERHS) between 1994 and 2009. The panel structure of the data allows us to treat the problem of selection, as the longitudinal dimension takes into account unobservable household characteristics that might explain why some receive food aid. We estimate the impact of food aid on production, using a panel Tobit with selection and endogeneity (Semykina and Wooldridge, 2010). We need an exclusion variable that can explain the choice of producing wheat but not the level of production: we choose the share of religious holidays during the planting season. Next, we also estimate the impact of food aid on commercialization decisions. We model separately selling and buying decisions and we allow food aid to impact the extensive and the intensive margins differently.

We find that food aid has a significant negative impact on the choice to produce, and hence on the number of producers. The average quantity of food aid in wheat received between 1994 and 2009 decreases the probability of being a wheat producer by three

percent on average. However, aid has no impact on the quantities produced. These results might explain the apparent contradiction between macro-level studies that found a decrease in domestic production due to aid and micro-level studies that found no impact. On the decisions concerning sales and purchases, we observe a shift in 2004, when the Ethiopian government implemented the Productive Safety Net Program (PSNP) and changed the rules of free food aid allocation. After 2004, food aid increases the probability of selling wheat. Moreover, in 2004, food aid also reduces the probability of buying wheat. At the intensive margin, food aid has no impact on quantities. Thus, food aid in Ethiopia is not additional[3] and seems even less so at the outset of the 2004 reform of the allocation criteria, perhaps temporarily.

The remainder of the paper is structured as follows. Section 2 sets the context of food aid in Ethiopia and describes households' heterogeneity with respect to market participation. In Section 4, we present the empirical framework that estimates the impact of food aid on households and our method for dealing with reverse causality and selection. Section 5 discusses the empirical results. Finally Section 6 concludes.

2. Context

2.1. Food Aid in Ethiopia

Ethiopia has been one of the world's major recipients of international food aid for decades, and has experienced recurrent episodes of drought and famine, as well as severe chronic food insecurity. Food aid, primarily emergency food aid, has been a typical response to both transitory and chronic food insecurity in the country, even when the weather and market conditions were relatively good. Over the last 20 years, food aid in Ethiopia has amounted to one-tenth of domestic production (Planel, 2005). Aid in wheat has represented 40 percent of domestic production since 1994 and even 100 percent in

2000 and 2003.[4]

In 2004, Ethiopia implemented the Productive Safety Net Program (PSNP) in collaboration with donor countries. The program seeks to ensure timely and predictable cash and/or food transfers to chronically food-insecure people, and further aims to prevent asset depletion at the household level and help build asset stocks at the community level. The first year of implementation of the PSNP coincided with a large increase in both the number of households receiving food-for-work and those receiving free food baskets. The program covers more than 50 percent of the communities (*woredas*) in the country.[5] These *woredas* also receive emergency relief in response to transitory crises. The PSNP extends aid from January to June so as not to interfere with farming activities. Criteria for the allocation of free food aid have changed over time. Before 2003, eligible for free food aid were the elderly or disabled persons, lactating or pregnant women, and those attending to young children. In 2003, the Disaster Risk Management and Food Security Sector revised the official guidelines and introduced the so-called Household Economic Approach. Still in use, this method for selecting free food aid recipients uses a baseline survey to assess hazard probability and coping strategies at the household level. For instance, it takes into account resources the household has available, such as livestock to sell or relatives from whom it can receive transfers. While the Household Economic Approach is based on sound economic theory, it is hard to apply on the ground, partly because the institutional channels through which aid is actually allocated have hardly changed. As regards food-for-work, allocation has changed as well with the implementation of the PSNP and reached more people.

Food aid eligibility is determined in three steps: the government decides the geographical allocation of aid at the regional level, regional leaders decide the allocation of aid by *woreda,* and local leaders select households within each community. The calendar for this

process is as follows. After the end of the rainy season (*meher*) in mid-September, the government estimates the number of households by *woreda* likely to be in need during the upcoming year. It then publishes its annual humanitarian requirement and calls for pledges by international donors in December or January. From January on, food aid is distributed every month to regions and to *woredas*. Clay et al. (1999) and Enten (2008) show that allocation at the *woreda* level follows negotiations between the government, the administrative staff and local people and, as a result, is not related to effective needs. Both papers (though written ten years apart) show that the Tigray region has been favored because of its close ties to the government. Hence, a geographical allocation based at least in part on considerations other than real needs seems to be constant at least since the end of the Derg, the authoritarian regime that governed Ethiopia from 1974 to 1991. In a second step, *woreda* committees allocate food to Peasant Associations (PAs). We have no documentation on this stage of the allocation, but we can expect that again some PAs are favored – and as there has been no clear change of the political leadership over the timespan of our data, we can expect that favored PAs remained consistent. PA leaders and local officials prepare lists of beneficiary households and manage distribution. Local leaders are ostensively elected through "free and fair" elections, but in practice manipulation and threats take place (Human Rights Watch, 2010). In order to avoid repression or exclusion from federal support, households tend to vote for the incumbent, so rural voters have largely acted in favor of the ruling national coalition for many years. Thus, the group that receives food aid is likely to include politically connected households and unlikely to have renewed much since the mid-1990s, as the same local elites has been in charge continuously.

Aid distribution begins in January and ends in September just before the harvest season, hence, before a household decides on production for the following agricultural season.[6]

Beneficiaries are supposed to receive a basket (fixed per eligible household member, containing cereals, vegetables oil and pulses) each month for at least three months, though actual distribution is far less predictable. The implementation of the PSNP suffers from payment delays and regional differences in implementation (Hoddinott et al., 2012). Targeting under the new Household Economic Approach is less based on easily observable characteristics such as age and gender than the previous system. Given Ethiopia's weak institutions, aid distribution is subject to capture. As a result, according to Planel (2005), only 22 percent of food-insecure people received some aid, either because their district was not targeted or because their household was not selected. Even for recipient households, the actual timing of food distribution seems to vary a lot, aid being distributed over a yearly period of from three months to six or nine, depending on the *woreda*, without clear links with their particular needs.

2.2. Related literature

As one of the countries most dependent on food aid, Ethiopia has been the focus of numerous studies.

A first stream of work focuses on targeting and dependency. Asfaw et al. (2007) investigate the determinants of participation in food aid programs and the impact of such programs on poverty reduction, based on the ERHS surveys from 1999 and 2004. They show that initial asset endowments and households characteristics such as size are the main determinants of poverty alleviation and food-aid dependency. Participation in food-aid programs reduces poverty, but imperfect targeting reduces their efficiency. Broussard et al. (2012) also study the distribution of food aid in Ethiopia using the ERHS data, focusing in particular on the impact of political connections and involvement in village organizations. They find that past consumption is used to select aid beneficiaries but is not correlated to the amount of aid. One explanation for this striking result is that

once the group of recipient households is defined, there is a desire to share aid equally within the group. Another possibility is that it is more costly to monitor the actual amount of aid than the identity of who receives it. Moreover, powerful households are likely to manipulate aid allocation. Little (2008) focuses on the problem of food aid dependency. Based on quantitative and qualitative data from 1999-2000 and 2002-2003, he suggests that food aid plays an important role in recovery strategies, but few households depend excessively on it for a long time. The absence of dependency is due to the fact that food aid is too uncertain and too poorly timed. Bevan and Pankhurst (2006) have conducted interviews in 20 villages, including the villages surveyed in the ERHS panel. Their study gives a sense of attitudes towards food aid and food-for-work. Respondents mention negative effects of food aid such as long-term dependency that makes people lazy. They also claim that food aid may come too late, is insufficient and distributed in centers that are too far away.

A second stream of literature investigates the impact of food aid on production and food prices, and gives mixed evidence. Using a computable general equilibrium, Gelan (2006) provides strong evidence of the disincentive impact of food aid on domestic food production. Levinsohn and McMillan (2007) use non-parametric tools to study the impact of food aid on rural and urban Ethiopia. Working with two "Expenditure and Consumption" surveys conducted by the Central Statistical Authority, the authors employ a standard supply-and-demand framework to estimate the likely impact of food aid on cereals prices. They estimate the magnitude of the first-order welfare effects of a decrease in food price and find that poorer households benefit proportionally more from a decrease in the price of wheat. This analysis is criticized by Kirwan and McMillan (2007) who find no apparent relationship between food aid and producer prices, and argue that the computed impact is based on unrealistic assumptions. Assefa Arega and Shively (2014)

focus on the impact of food aid on food prices and find that it has none in Ethiopia. Based on micro and macro data, Dayton-Johnson and Hoddinott (2004) and Abdulai et al. (2005) also find no evidence of a negative impact of food aid on local agricultural production, labor supply or investment. Their micro-analysis is based on data from the 1994 and 1995 ERHS. More precisely, the authors find a negative correlation in descriptive statistics between food aid and labor supply, on-farm investment, and participation in labor-sharing groups, and a negative sign in estimations without accounting for endogeneity of aid allocation. However, once they control for variables that might relate to selection such as age, gender and education of household head – as well as household's land holdings, size and location – the disincentive effects disappear.

All these studies looks at static effects and assume that all households will react in the same way. However Singh et al. (1986) show that due to the non-separability of consumption and production choices, agricultural households should react to prices differently depending on how they participate in markets. Key et al. (2000) and more recently Bellemare and Barrett (2006) provide empirical evidence on this point. Bellemare and Barrett (2006) distinguish three types of households, net sellers, net buyers and autarkic households, that differ in their production response to a rise in prices.

To push their argument one step further, it is also likely that these three types of households will react differently if they receive food aid, not only in terms of production but also whether they buy or sell (and the associated quantities). To our knowledge, only one paper, (Yamano et al., 2000), looks at the impact of food aid in such a framework but the authors focus on quantities and do not take into account food aid selection. Distinguishing between free food aid and food-for-work, because they argue that the forms of aid may differ in their income effects, the authors find that receiving cereals from food-for-work decreases purchases of wheat, while free food aid has a negative but

non-significant impact on purchases. Food aid has no impact at all on crop sales.

3. Data

Our data comes from a longitudinal survey which covers around 1500 households in 18 villages in rural Ethiopia from 1994 to 2009.[7] Villages are selected so as to account for the diversity of farming systems in the country. These data are not nationally representative but can be considered as broadly representative of households in non-pastoral farming systems as of 1994 (see Dercon and Hoddinott (2004) for more details). The survey gives household characteristics, agriculture and livestock information, consumption, transfers and remittances, health, women's activities and food aid transfers, as well as information at the village level. The data cover two major changes on food aid policy in Ethiopia. The government published new guidelines for free food aid distribution based on economic household analysis in 2003, (DRMFSS, 2003) and started to implement the PSNP in 2004. The variables of interest are whether a household has received free food aid or food-for-work, and the quantities received. We focus on one crop, wheat, which is one of the major cereals in Ethiopia. From the mid-1990s, wheat consumption increased steadily in both urban and rural areas to become one of the priority strategic crops for solving food security challenges in the country (Tefera, 2012). Thus, a large share of food aid is provided in wheat (74 percent in our sample).

Table 1 provides descriptive statistics of the sample. The share of recipients is highly variable: only seven percent of households received free food aid in 1995 whereas almost 30 percent did in 2009. The share of household benefiting from food-for-work programs was stable during the 1990s at around 10–11 percent but fluctuated after 2000 with a large increase in 2004 (to 22 percent of households).[8] The share of recipient households varies from zero to almost 80 percent, depending on the village. The relatively small

number of villages covered by the surveys limits our ability to describe the impact of food aid at the village level, but the large random samples within villages allow us to estimate the impact of food aid within villages. Quantities of wheat received per household vary from 30 kilograms in 1995 to 100 kilograms in 1999.

The poverty rate decreases in the late 1990s and early 2000s, but returns to its previous level of more than 50 percent in 2009. Households cultivate 1.5 hectares on average, but production is quite variable. The worst harvest was in 1995 with only 533 kilograms produced by the average household, and the best was in 2009 with a production rate three times higher. The size of livestock holdings has increased continually from 1994 to an average size in 2009 of 5 tropical livestock units, or TRUs. (One tropical livestock unit equals 1 cow, 10 goats, 11 sheep or 100 chickens.)

[TABLE 1 HERE]

We define four types of market participation regarding wheat. Households can be non-involved, meaning they neither produce nor buy wheat, or they can be producers, buyers or sellers. Types are defined in gross terms. Hence, the definitions might overlap as some households both buy and sell wheat; but these are in very small number, making up only around two percent of our sample. Producers include households that sow even if they get no harvest for any reason.

All types of market participation – buyer, seller, autarkic and non-involved – exist in Ethiopia. The exception is 1995, when the data shows no autarkic households.[9] The share of households cultivating wheat (for their own use or to sell) increases over time, going from 24 percent in 1994 to 32 percent in 2009. At that point, 55 percent of households were non-involved in wheat, 10.04 percent were sellers and 15.96 percent buyers, and 19.83 percent were in autarky. Market status is not stable across rounds. Substitution seems to happen over time, mostly between buyers and non-involved households, and to a

lesser extent between seller and autarkic households. Being a seller appears to be the most stable status.

In the descriptive statistics, food aid recipients differ from other households in terms of their market status. Table 2 suggests that recipient households produce less and are more likely to be in the non-involved category. The differences could suggest that food aid has an impact both on the choice to produce, buy or sell wheat and on the quantities produced and exchanged. Nevertheless, we cannot neglect the effect of selection of recipient households.

Looking at targeting criteria (Table 3), recipient households have fewer, and older, members. They have fewer children on average, though we would have expected the opposite, given the official allocation guidelines before 2004. Food-for-work and free food aid recipients seem to differ in terms of agricultural assets and household composition. Households receiving free food are smaller than those receiving food-for-work but contain more old-age members. Food-for-work households, as expected, cultivate less land than other households and have less livestock.

[TABLE 2 HERE]

[TABLE 3 HERE]

4. Empirical Specification

4.1. On Production

We model simultaneously the production decision and the quantity produced, allowing food aid to affect both stages differently. We run a panel Tobit type II with selection and

endogeneity (Semykina and Wooldridge, 2010). The model is defined by :

$$\begin{aligned} y_{it} &= y_{it}^* * s_{it} \\ s_{it} &= \mathbb{1}_{s_{it}^*>0} \\ y_{it}^* &= x_{it}\beta + \gamma_1 FA_{it} + c_{i1} + u_{it1} \\ s_{it}^* &= x_{it}\beta_{2t} + z_{it}\delta_t + \gamma_{2t} FA_{it} + c_{i2} + u_{it2} \end{aligned} \tag{1}$$

where y_{it} is the quantity of wheat produced in one year t by a household i, and s_{it} is the decision to produce. Both are observed if s_{it}^*, the latent variable that drives production decision, is higher than 0. y_{it}^* is the latent variable that drives the level of production. FA_{it} is the quantity of wheat aid received in the last 12 months (through free food distribution and/or food-for-work programs) by each household. If food aid is well targeted we should expect that it effects neither the decision to produce nor the quantities. We allow control variables, x_{it}, to affect differently both levels of decisions. Control variables are meant to capture market conditions and transactions costs: whether there is a daily market within the peasant association, the distance to the nearest market and regional dummies. We also add consumption and production shifters such as household size (per adult equivalent), the age of the household's head (as it could affect the productivity), whether the household is poor, the amount of non-food consumption, livestock size (in tropical livestock units) and the area of cultivated plot in hectares. The household size takes into account the fact that larger families can allocate more labor on their plots. The size of livestock holdings matters in two ways for cereals production: first, part of the harvest is used to feed the livestock; second, manure is used as a fertilizer and may improve harvest. Poor households may invest less on agriculture because they are cash-constrained; they may also cultivate less risky (hence, often less productive) crops in order to reduce risk. We also include the share of women, children and old people

within the household in order to control for observable characteristics that could explain food-aid allocation and affect productivity and demand for food. Finally we control for climatic shocks by including a dummy which is equal to one if the household declares that rain did not come in time during the growing season. We also take into account health shocks, namely, whether one household member was sick during the previous month. We cannot control for health shocks that happen during the growing season, but we can expect that recent illness is a good proxy for previous bad health.

The estimation procedure is as follows:

- For each round, we estimate $\mathbb{P}(s_{it} = 1|z_i) = \Phi\left(z_{it}\delta_t^a + \gamma_{2t}FA_{it} + \overline{z}_i\xi_t^a + \overline{FA}_i\xi_{2t}^a\right)$ with $\overline{z}_i$ is the individual mean over time of z_{it} and $\overline{FA}_i$ the average quantity of food aid received by household i over time.
- Next, we compute the inverse Mills ratio, $\hat{\lambda}_{it}$.
- For $s_{it} = 1$ we estimate a pooled two stage least square with $y_{it}^* = x_{it}\beta + \overline{z}_i\nu + \gamma\hat{\lambda}_{it} + e_{it}$ using 1, z_{it1}, $\hat{\lambda}_{it}$ and $\overline{z}_i$ as instruments where z_{it1} represents variables included in z_{it} but not in x_{it}.
- Finally, we estimate the variance applying a panel bootstrap.

Three issues arise with this type of estimation: endogeneity of food aid allocation, reverse causality, and the need to have an exclusion variable that differentiates between the decision to produce and the level of production.

First, on the issue of selection, the distribution of food aid is not random, only because of targeting. We exploit the panel nature of the data in order to control for fixed heterogeneity in the distribution of food aid. In doing so, we assume that endogeneity is conditional on the unobserved household effect, c_{i2}, only through the time averages of the variables. This is a reasonable assumption, because the institutional setting of food aid

allocation as presented previously has not changed much, and neither has the political party of PA leaders who ultimately allocate aid to a given household. We assume implicitly that PA leaders will favor the same households, and do not favor some households just before the elections and others just after, for instance.

The equations above relate food aid received by a household in year t to its production during the same year. Actually, food aid is mostly distributed during the lean season between April and September. It is also during these precise months that households decide what to produce during the main harvest (*meher*), which starts in October and goes through December. Normally, there is no aid distributed during the *meher* harvest.[10] There is also a minor harvest in May and June (*belg*), during which wheat is not produced. Rain in June and July is a good predictor of the *meher* harvest to come, and food aid could be adjusted accordingly. In practice, however, the amount of aid is not revised before August and due to regular delays (DRMFSS, 2012), actual quantities given to households start to be affected only in September and more often after January (see Figure 1 in Appendix A for an illustration of the timing in 2004). Hence, because of this timing, it seems that the concern of reverse causality – that is, that the quantity of food aid received in year t might depend on the level of production in year t – can be ruled out. Moreover, it is also reasonable to examine the impact of aid received on the production of the same year, and safely ignore any lagged impact on following year's harvest.

For our estimation strategy to hold, we need an excluding variable that would explain the decision to produce but not the level of production. We choose the share of religious holidays during the planting and growing seasons, depending on the religious group in which a household belongs. Our argument is that different religious groups have different preferences and production choices. Some prohibitions (such as dairy products for Orthodox Christians) may favor the production of alternative products. In choosing this

variable, we rely on Kijima and Gonzalez (2013) who find that religion does not affect agricultural productivity but it does the choice of crops (hence, producing wheat or not).[11] Table 4 shows the expected probability of being a wheat producer depending on their religious group and the share of off days during planting and sowing (controlling for other household characteristics). The probability differs across religious groups and decreases with the share of off-days.[12]

[TABLE 4 HERE]

4.2. On Sales and Purchases

We use the same Tobit specification for sales and purchases. However, it is harder to find a variable that might explain the decision to sell or buy and not the quantities. Hence, we just rely for identification on the nonlinearity of the inverse Mills ratio. Later, we will present a robustness check with the same excluding variable that we have used for production. Moreover, we estimate separately on buyers and on sellers, although ideally one would prefer to run a simultaneous system (Bellemare and Barrett, 2006).

Selling and buying decisions may be driven by considerations other than food aid, namely characteristics related to production and market conditions. Pender and Alemu (2007) find that a rise in the production of maize and teff (another cereal grown in Ethiopia) results in a rise in sales. Hence, we control for the quantity of cereals produced. As some households may be self-sufficient in food even though they do not grow wheat (because they rely on other crops), we control for the total area cultivated by the household. As a proxy for market opportunities, we take distance to the nearest market and the frequency with which the local market is held. We expect these latter variables to have a smaller impact on buyers than on sellers, as buyers are more constrained. Distance and transport cost may also affect the quantities that are sold or bought. We control the price level with a food price index computed at the village level, which is not subject to reverse causality

because it is not solely the price of wheat. We also add household characteristics such as size and composition, poverty status (as wheat is more expensive than other crops), and non-food expenditures as a proxy for wealth. Household size may work in both ways: having a large family may facilitate sales but it also increases the demand for food and the need to buy. We also control for climatic shocks and health shocks, as the household many need cash in order to buy medicine if someone is sick.

5. Results and Analysis

5.1. On Production

Table 5 shows the results of the estimation of the production system. It reports how many times a variable has a positive or a negative impact on the probability of producing wheat, and how many times the estimate is statistically significant. The average quantity of food aid received between 1994 and 2009 has a negative and statistically significant impact on the probability of being a producer. Thus food aid, once controlled for its endogeneous allocation, is shown to reduce the number of producers. A 10 kg increase in food aid in each round reduces the probability of being a producer by 3 percent in each round (see table 6). Current food aid has no impact on the decision to produce, except once, in 1994 where it reduced the probability of growing wheat. In that year, a 10 kg increase in food aid (for an average of 150 kg per year and household) reduces the probability of being a producer by 6 percent. Turning now to the quantities produced, food aid is shown to have no significant impact, even if the sign is negative as expected (Table 7).

The fact that food aid has different effects on the decision to produce and on the level of production could help explain why some macro papers have found a decrease in production due to food aid (Lavy, 1990) while no impact showed up in micro studies (Abdulai et al., 2005). Overall, these results suggest that food aid is not perfectly

additional, probably because of poor targeting. However, one cannot infer from these results that the food security of recipient households has not improved. They have received wheat for their consumption, possibly resulting in better nutritional standards.[13] It may also be the case that they have stopped producing wheat and started growing another crop.

[TABLE 5 HERE]

[TABLE 6 HERE]

[TABLE 7 HERE]

The excluding variables explain the decision whether to produce wheat. The share of off-days during the sowing season has a significant impact, but the sign is not constant over time. It could be due to the fact that in 2004 and 2009 (the years for which the effect is positive) there are no differences in the share of religious holidays between Muslim and other religious groups. There are also differences in the quantities produced between religious groups, with Orthodox Christians producing the most.

Finally, market conditions affect production decisions at both margins. Living far from the nearest market increases the probability of growing wheat and the quantities produced. Having a market within the peasant association open one day more, increases wheat production by 124 kg, a significant impact.

5.2. On Sales and Purchases

5.2.1. Being a seller and the level of sales

Selling decisions are estimated on a smaller sample of wheat producers (around 350 observations for each round, except in 2009 with 629 observations). The smaller size could affect the precision of estimates. The impact of food aid changes over time (Table 8). The

sign of the impact shifts in 2004. Before that year, the impact is negative and statistically non-significant; in 2004 and again in 2009, the impact is positive and significant. For instance in 2009, ten additional kilograms of food aid increases the probability of selling by 23 percent, which is relatively important compared to the impact of cultivating one more hectare the same year (see table 9). This could be related to 2004 being the starting year of the PNSP, with a large increase in the number of aid recipients, perhaps at the expense of the quality of targeting. When we disentangle food aid between food-for-work and free transfer, we find that it is the latter that explains most of the shift (see Table 15 in Appendix B). Hence, in 2004, some households, for whom aid was not additional, actually received it. Control variables are in line with expectations: the decision to sell is positively correlated with higher production, better market conditions and a higher food price.

[TABLE 8 HERE]

[TABLE 9 HERE]

We find no impact of food aid on the level of sales (Table 10). Looking at other determinants, cereal production has a statistically significant impact on the level of wheat sales. When cereal production increases by 100 kilograms, households sell 16 additional kilograms of wheat; this ratio should be higher if we focus on wheat production only. The size of livestock holding has a negative impact on the quantities of wheat sold. Other factors that affect household demand have non-significant impacts.

[TABLE 10 HERE]

5.2.2. Being a buyer and the level of purchases

The impact of food aid on the decision to buy switches again in 2004 (Table 11). Before 2004, the impact of aid is positive but not statistically significant. Afterwards, the impact

turns negative, but it is significant only in 2004, when increasing food aid by 10 kilograms reduces the probability of being a buyer by 1.3 percent (see table 9). When we disaggregate by types of aid (Table 17 in Appendix B), it appears that the shift is driven by food-for-work. One explanation is that the PNSP was not perfectly implemented at the beginning (Hoddinott et al., 2012): households received excessive quantities of food aid or with delay, so that food aid was no longer additional.

As for other determinants of the decision to buy, being poor reduces the probability of buying, and market conditions matter, but in a somewhat non-intuitive way. The decision to buy increases with distance and decreases with the frequency of the local market. The latter effect may come from the survey design. Households are asked to report all the purchases they made during the previous month, so it is conceivable that they fail to report some purchases if they are used to buying small quantities very frequently from a market nearby. This could also explain why we observe a positive (but non-significant) effect of the frequency on the quantities.

[TABLE 11 HERE]

[TABLE 12 HERE]

Food aid does not affect the quantities that are bought (Table 12). What matters is household composition – having more women in the household increases the purchases – as well as regional differences: living in Tigray, a food-insecure region with low and volatile agricultural production, results in larger quantities purchased.

5.3. Robustness Checks

We run several regressions to test the robustness of our results. First, we do not restrict the panel to be balanced, second we take food aid in all crops, not only wheat, as the

explanatory variable: results remain similar. For the production equations, we use the household's religious group and the share of religious holidays as excluding variables (see Tables 13 and 14 in Appendix B). Thus the first-stage equation does not change, but religion can no longer affect the quantities produced by a household.

For selling and buying decision,s we redo the estimation with the panel unbalanced and considering food aid in all crops (see Tables 15 to 18 in Appendix B). We also use excluding variables that would explain the decision to buy (or sell) but not the quantities, and we consider livestock owned and religion. The reason is that some religious groups may rely on markets more easily because they have access to a larger network (Helpman et al., 2008). Also, households with some livestock may prefer selling some chicken rather than wheat. Finally, we replace the food price index with unit values for wheat, computed as the ratio between the value of purchases (or sales) and the quantities in kilograms at the household level. In 2009, there is some discrepancy between the food price index and households' unit values: unit values remained at the same level as in 2004 while the price index tripled. One explanation might be that households, facing higher prices, turned to lower quality wheat in 2009. We compute separately unit values for sales and for purchases, averaged at the village level. When there is no observation (this happens most often for sales), we have imputed the regional mean. Results remain the same.

Overall, the results are robust to the specification. Food aid reduces the probability of producing wheat in all years and, after 2004, also reduces the probability of selling or buying wheat, without significant impact on quantities.

6. Conclusion

This paper examines the impact of food aid on households' production, sale and purchase of wheat in Ethiopia, a major receiver of such aid. The framework models households' decisions, not only on quantities (at the intensive margin), but also on the degree of their market participation (at the extensive margin). The endogeneity of aid is dealt with by the inclusion of observable household characteristics, based on the actual allocation procedures in Ethiopia and using the panel structure of the data in order to account for unobservable households characteristics. Food aid is shown to impact the extensive margin. It reduces the probability of producing wheat, but the size of the effect is rather small. After 2004, it increases the number of sellers and decreases the number of buyers. Hence, food aid might be one reason why households in Ethiopia have changed their market participation over the years. However, food aid has no impact at the intensive margin, on quantities.

The shift in 2004 is simultaneous to the introduction of new guidelines for food aid allocation and the start of the PSNP which extended the number of food aid recipients. The impact on the number of sellers comes mostly from food-for-work, while the impact on the number of buyers come from households receiving free food aid, suggesting a deterioration of targeting in the first years of the new program.

Market conditions also matter: improving market access (distance to the nearest market and its frequency) and investing on production infrastructure (such as storage) are important in order to promote commercialization.

As a consequence, in the case of Ethiopia, concerns of a possible large negative impact of food aid on local production and markets are probably not relevant. Our results suggest that the new guidelines of aid allocation should be carefully evaluated, not only based on their economic principles, but also taking into account their actual implementation in the

institutional context of Ethiopia. The sophistication of the criteria could lead them to appear as a kind of black box that could be manipulated by people in charge of aid allocation. Moreover, our results suggest that aid programs that improve food distribution and market access, such as better roads and storage facilities, will improve households participation in markets

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Notes

[1]According to INTERFAIS, the Food Aid Information System created by the World Food Programme (WFP), in 2004, Ethiopia was the second largest recipient of food aid in the world in 2004 and largest from 2008 to 2011. About 5 million Ethiopians live in food insecurity, especially in rural zones.

[2]In 1999, the amount of wheat distributed in Ethiopia was equal to domestic production.

[3]It means that not all aid is consumed in addition to usual food consumption. Additionality is the extent to which food aid provided adds to total food consumption.

[4]Data from the UN's World Food Programme for wheat aid and from the Food and Agriculture Organization for wheat production. Only one quarter of aid in wheat comes from local purchases; thus general equilibrium effects should be rather small (INTERFAIS-WFP).

[5]A *woreda* is an administrative unit, defined below region and zone, and roughly equivalent to district designations elsewhere. *Woredas* are composed by *kebeles* (group of villages) and peasant associations (PA). In order to obtain land, households have to register with the PA which keeps the list of recipient households. A peasant association can cover many villages. For instance, the Adele Keke PA consists of 28 villages.

[6]See Figure 1 in Appendix A for an illustration of the timing in 2004.

[7]We drop the second round, as its reference period is six months instead of one year, and the fourth round, which surveyed additional villages.

[8] 2004 marks the end of a drought and the first implementation of the PSNP, which could explain the higher share of food-for-work.

[9]"In the 1995/96 season, the Ethiopian Grain Trading Enterprise was explicitly mandated to support producers' maize and wheat prices at the stated support price" (Negassa and Jayne, 1997). This market opportunity could explain the large increase in sellers in 1995 and the absence of autarkic households.

[10]In case of delays, we could expect some marginal distribution. We have no clue that confirms that this actually takes place.

[11]Religious off-days are for instance, Easter, Pentecost, Holy Friday and the Ascension for Catholics; Ramadan for Muslims; and we add civil holidays for all groups.

[12]The share of religious holidays varies by year and region because the dates of some holidays change and the growing season is not exactly the same in each region.

[13]Nutritional standards imposed by the WFP for instance are high. In addition, Quisumbing (2003) shows that food aid has a positive impact on child nutrition (see also Yamano et al. (2005)).

Table 1: Descriptive Statistics

	1994		1995		1999		2004		2009	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Poor (%)	48.23	*49.98*	55.19	*49.75*	36.24	*48.09*	34.87	*47.67*	52.14	*49.97*
Household Size	6.06	*2.95*	6.13	*3.03*	5.31	*2.55*	5.74	*2.5*	5.67	*2.55*
Total Food Consumption (kg)	260.26	*331.68*	233.74	*376.36*	284.64	*1188.15*	224.88	*239.32*	223.75	*470.13*
Non Food Consumption (Birr)	101.46	*132.56*	83.07	*154.51*	69.8	*78.08*	111.98	*158.19*	192.16	*367.09*
Food Price Index	100.74	*11.83*	120.29	*12.00*	113.51	*13.14*	115.68	*8.48*	354.49	*18.81*
Livestock	2.61	*3.38*	2.52	*3.38*	2.91	*2.78*	3.04	*3.24*	5.11	*5.6*
Cultivated Area (ha)	1.56	*1.46*	1.83	*7.73*	1.29	*1.1*	1.7	*1.8*	1.56	*1.37*
Total Production (kg)	723.34	*1200.92*	533.19	*940.59*	1177.8	*1432.12*	1375.02	*1311.46*	1499.22	*1772.06*
Wheat Cultivators (%)	24.11	*42.79*	24.85	*43.23*	28.8	*45.3*	31.9	*46.62*	31.76	*46.57*
Wheat Production (kg)	362.78	*423.08*	311.73	*415.75*	431.73	*418.07*	388.71	*405.79*	479.74	*542.12*
Wheat Sellers (%)	7.57	*26.46*	24.85	*43.23*	13.00	*33.64*	17.44	*37.96*	10.04	*30.06*
Wheat Buyers (%)	16.21	*36.87*	15.50	*36.49*	20.16	*40.13*	21.06	*40.79*	15.96	*36.64*
Wheat Autarkic (%)	14.49	*35.21*	0	*0*	10.94	*31.23*	11.85	*32.33*	19.83	*39.89*
Wheat Non Involved (%)	62.13	*48.52*	61.72	*48.62*	57.61	*49.43*	51.52	*49.99*	55.14	*49.75*
Wheat Sales (kg)	202.91	*154.59*	216.46	*273.50*	230.08	*218.75*	294.63	*363.53*	285.99	*328.81*
Wheat Purchases (kg)	43.57	*84.43*	59.94	*272.51*	70.70	*151.21*	50.91	*80.75*	71.20	*389.84*
Food-for-Work Recipient (%)	10.12	*30.17*	10.99	*31.29*	10.86	*31.13*	22.66	*41.88*	5.18	*22.18*
Wheat Food-for-Work (kg)	87.51	*79.19*	37.72	*56.19*	188.94	*199.29*	18.33	*46.4*	72.71	*93.84*
Food Aid Recipient (%)	15.22	*35.94*	7.57	*24.46*	27.65	*44.74*	26.09	*43.93*	28.23	*45.03*
Food Aid (kg)	69.84	*84.95*	33.14	*28.44*	102.51	*103.81*	85.11	*92.17*	71.91	*83.54*
Wheat Aid Recipient (%)	9.46	*29.28*	6.5	*24.66*	0.74	*8.57*	19.42	*39.57*	16.54	*37.71*
Wheat Aid (kg)	80.07	*54.15*	29.31	*19.08*	114.88	*81.32*	85.91	*80.02*	58.14	*55.44*
Number of Respondent Households	1215									

Note: ERHS data for a balanced panel of households. Average quantities of food aid, wheat aid and wheat received through food-for-work programs are computed only by beneficiaries. Production is computed among cultivators. Total production excludes chat, coffee and ensete (Ethiopian banana). Cultivators include households that sowed wheat but did not harvest because of shocks. Non food consumption is in nominal Birr, the Ethiopian currency. Livestock is computed in tropical livestock units.

Table 2: Market Participation Status and Quantities Depending on Whether a Household Receives Wheat Aid

	No Food Aid	Food Aid	Difference
Seller			
Participation	16.22%	6.03%	***
Production (in kg)	529.08 (544.79)	402.85 (396.11)	**
Sales (in kg)	249.42 (294.93)	197.39 (200.19)	**
Buyer			
Participation	18.18%	16.05%	
Production (in kg)	55.65 (170.34)	31.27 (103.88)	**
Purchases (in kg)	58.42 (236.24)	64.34 (93.19)	
Autarkic			
Participation	12.67%	4.90%	***
Production (in kg)	308.80 (301.01)	141.21 (141.09)	***
Non-involved			
Participation	54.42%	74.33%	***

Note: All rounds are pooled. Standard deviations are in parentheses. For each market participation regime, we test whether the means are equal between non-recipients and wheat aid recipients. Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 3: Household Characteristics and Food Aid

	(1) Non Food Aid	(2) Food-for-Work	(3) Free Food Aid	(4) 1-2	(5) 1-3	(6) 2-3
Poor (%)	44.9	51.68	45.81	***		**
Household size	5.99	5.88	5.17		***	***
Children (<14)	2.53	2.55	2.15		***	***
Old People (>60)	0.35	0.28	0.41	**	***	***
Livestock (TLU)	3.59	1.96	2.72	***	***	***
Cultivated Area (ha)	1.71	1.01	1.4	***	***	***
Total Production (kg)	1237.34	515.67	735.4	***	***	***

Note: All rounds are pooled. The fourth column tests if the mean is equal between non food aid recipients and food-for-work recipients. Column 5 tests the equality between non food aid recipients and free food aid recipients and finally column 6 tests equality between food-for-work recipients and free food recipients. Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 4: Probability of being a wheat producer depending on the share of religious holidays

	(1) Less than 1%	(2) Between 1 and 5%	(3) More than 5%	(1) - (2) = 0	(2) - (3) = 0
Orthodox	0.536	0.242	0.329	***	***
Muslim	0.193	0.103	0.096	***	
Protestant	0.682	0.007	0.009	***	*
Other religions	0.571	0.05	No obs	***	N. A

Expected Probability of being a wheat producer is computed from a probit that controls for round and regional effect, household characteristics (except religion) and market conditions. The share of religious holidays is computed for each year and each region to take into account geographical variations for the growing season and time variations for the religious holidays. Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 5: Determinants of Wheat Production: Discrete Choice, Panel Tobit Type 2

	+/-
Wheat Aid (in kg)	0(2)/1(3)
Average wheat aid over rounds (kg)	0(0)/3(5)
Share of off days during planting season	2(2)/1(3)
Religion (ref.Orthodox Christian)	
Protestant	3(4)/1(1)
Muslim	0(2)/3(3)
Other religions	4(5)/0(0)
Cultivated area	3(4)/0(1)
Rainfall shock[a]	2(2)/1(2)
Livestock size (TLU)	2(3)/2(2)
Illness in past 4 weeks	0(1)/0(4)
Household Size	0(3)/0(2)
Log(Household head age)	0(3)/0(2)
Proportion of females	0(1)/2(4)
Proportion of children	0(2)/0(3)
Proportion of old	0(1)/0(4)
Non food consumption	2(4)/0(1)
Poor dummy	0(3)/1(2)
Region (ref.Tigray)	
Amhara	2(3)/2(2)
Oromia	2(3)/1(2)
SNNP	0(1)/4(4)
Market - No.Of days per week within PA	2(2)/3(3)
Log(distance to the closest market)	5(5)/0(0)
Constant	0(0)/4(5)
Average characteristics	Yes

[a]: Omitted in one regression due to collinearity. Lecture: The average quantity of wheat aid received by a household over the five rounds (second line) decreases the probability of being a wheat producer by five times and significantly by three times. Significance level at 5%.

Table 6: Impact of receiving ten additional kilograms of wheat aid on each round

	1994	1995	1999	2004	2009
Impact on the probability of being a wheat producer	-0,46%	-2,21%	-5,90%	-2,10%	-5,84%
Impact on the probability of being a wheat seller	-91,15%	X	-10,77%	-6,88%	-43,82%
Impact on the probability of being a wheat buyer	-4,32%	0,48%	-0,35%	-1,80%	2,07%

Table 7: Determinants of Wheat Production: Quantities, Panel Tobit Type 2

	Wheat Production (kg)	Standard Errors
Wheat Aid (in kg)	-0.601	(0.543)
Cultivated area	-0.651	(16.214)
Rainfall shocks	976.518	(145.823)***
Livestock size (TLU)	13.607	(5.072)***
Illness in past 4 weeks	8.760	(58.404)
Household Size	29.678	(10.453)***
Log(Household head age)	-154.749	(61.732)**
Proportion of females	-0.115	(83.414)
Proportion of children	-330.755	(129.358)**
Proportion of old	-77.181	(117.395)
Non food consumption	0.621	(0.139)***
Poor dummy	-67.171	(56.236)
Region (ref.Tigray)		
Amhara	-402.422	(107.351)***
Oromia	-10.109	(98.541)
SNNP	-244.426	(114.053)**
Log(distance to the closest market)	-248.673	(43.035)***
Market - No.Of days per week within PA	124.646	(19.522)***
Religion (ref.Orthodox Christian)		
Protestant	-307.333	(91.941)***
Muslim	-149.384	(57.095)***
Other	-174.434	(67.273)***
Constant	373.276	(237.278)
Round Fixed effects	Yes	
Number of obs	1,691	
Pseudo R-squared	0.39	
Number of bootstrap rep.	999	

Significance levels: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Instruments: Share of religious holidays, religion, average household variables, inverse Mills ratio. All rounds are pooled.

Table 8: Determinants of Wheat Selling: Discrete Choice, Panel Tobit

	+/-
Wheat Aid (in kg)[a]	2(2)/0(2)
Average wheat aid over rounds (kg)[a]	0(1)/1(3)
Household Size	0(2)/1(3)
Log(Household head age)	0(1)/0(4)
Poor dummy	0(4)/0(1)
Proportion of females	0(3)/1(2)
Proportion of children	0(2)/0(3)
Proportion of old	0(1)/0(4)
Religion (ref.Orthodox Christian)	
Muslim[b]	0(1)/0(3)
Protestant[b]	0(1)/0(3)
Other religions[b]	0(3)/0(1)
Non food consumption	0(2)/1(3)
Cereal production	3(4)/0(1)
Cultivated area	1(2)/0(3)
Livestock size (TLU)	0(2)/0(3)
Illness in past 4 weeks	0(2)/0(3)
Rainfall shocks[a]	1(3)/0(0)
Market - No.Of days per week within PA[b]	4(4)/0(0)
Log(distance to the closest market)[b]	1(2)/2(2)
Food price index[b]	4(4)/0(0)
Region (ref.Tigray)	
Amhara[b]	0(1)/2(3)
Oromia[b]	0(2)/1(2)
SNNP[a,b]	1(2)/0(1)
Constant	0(1)/2(4)
Average characteristics	Yes

Significance level at 5%.[a] : variable predict success perfectly for one or two rounds. [b] : due to convergence failure, this variable was dropped in 1995.

Table 9: Impact of receiving ten additional kilograms of wheat aid by round

	1994	1995	1999	2004	2009
Impact on the probability of being a wheat producer	-6,64%	1,13%	4,31%	-0,02%	-0,12%
Impact on the probability of being a wheat seller	-18,49%	X	-3,00%	7,45%	23,90%
Impact on the probability of being a wheat buyer	1,73%	1,87%	0,42%	-1,38%	-3,51%

Table 10: Determinants of Wheat Sales: Quantity, Panel Tobit

	Wheat Sales (kg)	Standard Errors
Wheat aid	-0.765	(4.722)
Household Size	11.281	(13.171)
Log(Household head age)	-19.672	(80.251)
Poor dummy	-103.130	(87.190)
Proportion of females	36.694	(134.054)
Proportion of children	89.451	(169.511)
Proportion of old	29.970	(188.001)
Religion (ref.Orthodox Christian)		
Muslim	38.405	(68.909)
Protestant	67.259	(155.539)
Other religions	56.121	(149.024)
Non Food expenditure	-0.288	(0.285)
Illness in past 4 weeks	47.224	(88.834)
Rainfall shocks	1,659.195	(1,174.477)
Cereal production	0.166	(0.039)***
Cultivated area	-24.406	(25.235)
Livestock (TLU)	-15.055	(8.450)*
Market - No.of Days per week within PA	196.217	(185.690)
Log(distance to the closest market)	16.008	(90.130)
Food price index	12.504	(11.821)
Region (ref.Tigray)		
Amhara	-509.736	(596.019)
Oromia	-553.786	(661.035)
SNNP	165.475	(491.851)
Constant	-1,157.308	(1,312.311)
Round effects	Yes	
Number of obs	765	
R-squared	0.04	
Number of bootstrap rep	999	

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.Instruments: average individual variables, inverse Mills ratio.

Table 11: Determinants of Wheat Buying: Discrete Choice, Panel Tobit

	+ / -
Wheat Aid (in kg)	0(3)/1(2)
Average wheat aid over rounds (kg)	0(3)/0(1)
Household Size	0(4)/0(1)
Log(Household head age)	0(2)/0(3)
Poor dummy	0(0)/5(5)
Proportion of females	0(2)/0(3)
Proportion of children	1(4)/0(1)
Proportion of old	0(2)/0(3)
Religion (ref.Orthodox Christian)	
Muslim	0(4)/0(1)
Protestant	0(2)/1(3)
Other religions	0(3)/2(2)
Non food consumption	1(3)/0(1)
Illness in past 4 weeks	1(3)/0(2)
Rainfall shocks[a]	1(2)/1(2)
Cultivated area	0(0)/2(5)
Livestock size (lsu)	1(2)/0(3)
Market - No.Of days per week within PA	0(1)/4(4)
Log(distance to the closest market)	3(4)/0(1)
Food price index	1(3)/0(2)
Region (ref.Tigray)	
Amhara	2(3)/2(2)
Oromia	2(2)/0(3)
SNNP	2(3)/1(2)
Constant	0(2)/2(3)
Average characteristics	Yes

Significance level at 5%.[a]: due to collinearity, this variable was dropped in 1999.

Table 12: Determinants of Wheat Purchases: Quantity, Panel Tobit

	Wheat Purchases (kg)	Standard Errors
Wheat aid	-0.505	(0.503)
Household Size	3.548	(5.491)
Log(Household head age)	-19.157	(25.876)
Poor dummy	-22.082	(36.762)
Proportion of females	136.616	(65.639)**
Proportion of children	78.979	(66.085)
Proportion of old	59.622	(55.245)
Religion (ref.Orthodox Christian)		
Other	0.119	(31.403)
Muslim	-21.689	(59.733)
Protestant	-22.618	(24.657)
Non Food expenditure	0.020	(0.074)
Illness in past 4 weeks	19.572	(27.179)
Rainfall shocks	-23.826	(49.903)
Cultivated area	14.888	(26.252)
Livestock (TLU)	5.479	(5.202)
Market - No.of Days per week within PA	17.608	(16.626)
Log(distance to the closest market)	-16.456	(13.695)
Food price index	-0.259	(0.689)
Region (ref.Tigray)		
Amhara	-147.952	(39.554)***
Oromia	-98.865	(73.096)
SNNP	-157.920	(63.323)**
Constant	122.946	(144.569)
Round effects	Yes	
Number of obs.	1,069	
R-squared	0.03	
Number of bootstrap rep.	999	

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.Instruments: average individual variables, inverse Mills ratio.

Table 13: Determinant of Whether a Household Produces Wheat, Robustness Checks

	Unbalanced Panel	All Food Aid	Holidays and religion
Wheat Aid (in kg)	0(3)/1(2)	1(3)/0(2)	0(3)/1(2)
Average wheat aid over rounds (kg)	0(0)/5(5)	0(0)/3(5)	0(0)/5(5)
Share of off days during planting season	3(3)/1(2)	2(2)/1(3)	3(3)/1(2)
Religion (ref.Orthodox Christian)			
Protestant	1(1)/2(4)	2(4)/1(1)	1(1)/2(4)
Muslim	0(1)/2(4)	0(2)/3(3)	0(1)/2(4)
Other religions	2(5)/0(0)	4(5)/0(0)	2(5)/0(0)
Controls		Yes	

Other controls includes household composition, livestock size, cultivated land area, a dummy whether the household is poor, non food consumption in Birr, regional dummies and average variables over rounds of these variables. Significance level at 5%.

Table 14: Determinants of Wheat Production (kg), Panel Tobit

	(1) Unbalanced	(2) Holidays and religion	(3) Total Food Aid
Wheat Aid (in kg)	-0.750	-0.622	
	(0.472)	(0.603)	
Total food aid received in kg			0.309
			(2.293)
Religion (ref.Orthodox Christian)			
Protestant	-252.070		-311.169
	(88.117)***		(108.696)***
Muslim	-146.103		-151.030
	(54.296)***		(57.440)***
Other	-150.373		-169.949
	(55.892)***		(67.034)**
Controls		Yes	
Round dummies		Yes	
Number of obs	1,841	1,693	1,693
R-squared	0.06	0.07	0.10
Number of bootstrap rep		999	

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Other controls include household composition, livestock size, cultivated land area, a dummy whether the household is poor, non food consumption in Birr, regional dummies. Column (1) is the result of the specification with a unbalanced panel. Column (2) shows the results obtained when religious group is an excluding variable in addition of the share of religious holidays. Column (3) is the result when we use total food aid instead of wheat aid. The regression estimates the quantities produced by wheat production taking into account food aid endogeneity and sample selection.

Table 15: Determinant of Whether a Household Sells Wheat, Robustness Checks

	Unbalanced panel	Free Food Aid	Food-For-Work	Unit Value	All Food Aid	Instrumented
Aid (in kg)[b]	1(2)/0(2)	1(3)/0(0)	1(1)/0(2)	1(2)/0(2)	2(4)/0(0)	1(2)/0(2)
Average wheat aid over rounds (kg)[b]	0(1)/2(3)	0(0)/2(4)	0(2)/0(2)	0(1)/3(3)	0(0)/2(4)	0(1)/2(3)
Share of off days during planting season						3(4)/0(1)
Livestock size (lsu)	0(2)/0(3)	0(1)/0(4)	0(2)/0(3)	0(1)/0(4)	0(1)/0(4)	0(1)/2(4)
Religion (ref.Orthodox Christian)[b]						
Protestant	0(1)/0(3)	0(1)/0(3)	0(1)/0(3)	0(1)/0(3)	0(1)/0(3)	
Muslim	0(2)/0(2)	0(2)/0(2)	0(1)/0(3)	0(2)/0(2)	0(2)/0(2)	
Other religions	0(3)/0(1)	0(3)/0(1)	0(2)/0(2)	0(3)/0(1)	0(3)/0(1)	
Food price index[b]	4(4)/0(0)	3(4)/0(0)	4(4)/0(0)	0(2)/1(2)	3(4)/0(0)	1(3)/0(1)
Controls			Yes			

Other controls include household composition, livestock size, cultivated land area, a dummy whether the household is poor, non food consumption in Birr, regional dummies and their average over rounds. [b]: Drop in 1995 due to convergence problems or because it determines totally allocation. Significance level at 5%.

Table 16: Determinants of Wheat Sales (kg), Robustness Checks

Variables	(1) Unbalanced Panel	(2) Free Food Aid	(3) Food for Work	(4) Unit Value	(5) Total Food Aid	(6) Instrumented
Wheat aid	-0.512			-0.544		-0.319
	(2.014)			(3.325)		(0.772)
Free Food Aid		-3.378				
		(3.607)				
Food for Work			-0.225			
			(5.339)			
Total food aid received in kg					0.641	
					(1.007)	
Religion (ref.Orthodox Christian)						
Protestant	32.620	62.977	30.148	26.976	25.690	
	(114.106)	(124.135)	(113.657)	(118.315)	(112.643)	
Muslim	2.845	14.343	3.760	0.171	1.473	
	(36.537)	(42.370)	(37.654)	(44.313)	(38.307)	
Other religions	-22.705	-5.753	-21.622	-23.986	-24.984	
	(95.560)	(101.700)	(98.146)	(98.269)	(98.070)	
Livestock (TLU)	-7.702	-7.271	-7.424	-7.753	-6.935	
	(5.135)	(5.061)	(5.178)	(5.403)	(5.173)	
Food price index	-0.878	-0.287	-0.877		-1.074	-0.475
	(3.055)	(3.394)	(3.185)		(3.198)	(2.341)
Unit Value				-0.646		
				(2.700)		
Controls			Yes			
Round Dummies			Yes			
Number of obs	836	822	822	820	822	822
R-squared	0.11	0.07	0.12	0.10	0.12	0.24
Number of bootstrap rep			999			

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Other controls include household composition, livestock size, cultivated land area, a dummy whether the household is poor, non food consumption in Birr, regional dummies.

Table 17: Determinant of Whether a Household Buys Wheat, Robustness Checks

	Unbalanced panel	Free food aid	Food for work	Unit Value	All Food Aid	Instrumented
Aid (in kg)	0(3) / 1(2)	0(3) / 0(2)	0(3) / 1(2)	0(3) / 1(2)	0(2) / 0(3)	0(3) / 1(2)
Average wheat aid over rounds (kg)	0(3) / 0(2)	0(3) / 0(2)	0(3) / 0(2)	1(3) / 0(2)	0(3) / 0(2)	0(3) / 0(2)
Religion (ref.Orthodox Christian)						
Protestant	0(2) / 1(3)	0(2) / 1(3)	0(2) / 1(3)	0(2) / 1(3)	0(2) / 1(3)	
Muslim	0(4) / 0(1)	0(4) / 0(1)	0(4) / 0(1)	0(4) / 0(1)	0(4) / 0(1)	
Other religions	0(3)/ 2(2)	0(3)/ 2(2)	0(3)/ 2(2)	0(3)/ 1(2)	0(3)/ 2(2)	
Share of off days during planting season						0(2) / 2(3)
Livestock size (lsu)	1(2) / 0(3)	1(3) / 0(2)	1(3) / 0(2)	0(1) / 0(4)	1(3) / 0(2)	0(1) / 2(4)
Food price index	1(3) / 0(2)	1(3) / 0(2)	1(3) / 0(2)	3(5) / 0(0)	1(3) / 0(2)	1(4) / 0(1)
Controls			Yes			

Other controls include household composition, livestock size, cultivated land area, a dummy whether the household is poor, non food consumption in Birr, regional dummies and their average over rounds. Significance level at 5%.

Table 18: Determinants of Wheat Purchases (kg), Robustness Checks

Variables	(1) Unbalanced	(2) Free Food Aid	(3) Food for Work	(4) Unit Value	(5) Total Food Aid	(6) Instrumented
Wheat aid	-0.449			-0.523		-0.416
	(0.472)			(0.503)		(0.448)
Free food aid		-0.333				
		(0.375)				
Food for work			-0.586			
			(0.754)			
Total food aid received in kg					-0.019	
					(0.758)	
Religion (ref.Orthodox Christian)						
Protestant	-21.582	-18.577	-26.060	-22.670	-20.434	
	(22.012)	(25.561)	(23.885)	(25.861)	(25.210)	
Muslim	-16.954	-24.060	-22.933	-20.502	-25.161	
	(53.970)	(58.939)	(59.699)	(60.229)	(58.411)	
Other	-3.824	-5.897	-1.021	0.361	-7.435	
	(29.654)	(26.847)	(31.895)	(30.009)	(26.415)	
Livestock (TLU)	4.965	6.206	5.235	5.025	5.823	
	(4.564)	(5.386)	(5.082)	(5.085)	(5.991)	
Food price index	-0.166	-0.097	-0.189		-0.076	-0.223
	(0.649)	(0.603)	(0.662)		(0.602)	(0.523)
Unit Value				-4.791		
				(4.070)		
Controls			Yes			
Round Dummies			Yes			
Number of obs	1,174	1,069	1,069	1,068	1,069	1,073
R-squared	0.03	0.04	0.03	0.03	0.04	0.04
Number of bootstrap rep			999			

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Other controls include household composition, livestock size, cultivated land area, a dummy whether the household is poor, non food consumption in Birr, regional dummies.

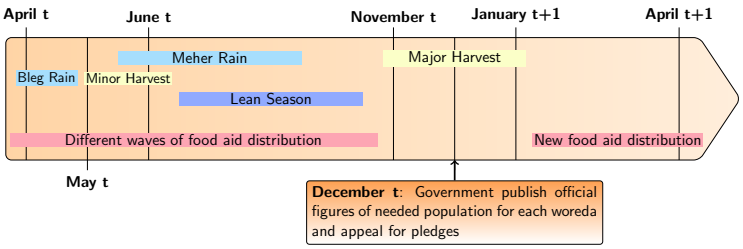

Figure 1: Timing of Food Aid Allocation and of the Survey

Appendix A. Timing

Figure 1 illustrates the timing between production, harvest, food aid and the survey in 2004. The red line from April to July 2004 represents the months when households were surveyed. The blue lines represent the rainy seasons (*meher* and *belg*). The yellow lines represent the harvest months. *Meher* harvest from November to January is the main harvest season, accounting for almost 90 percent of the annual production. The dark blue line represents the lean season. Finally the orange line is the food aid distribution which could occur in all months.

[FIGURE 1 HERE]

Appendix B. Robustness checks

Table 13 shows the robustness checks at the extensive margin for production. Table 14 shows the estimates for the quantities produced. Table 15 and 16 summarize the robustness analysis for the selling part. Table 17 and 18 summarize the robustness analysis for the buying part.

[TABLE 13 HERE]

[TABLE 14 HERE]

[TABLE 15 HERE]

[TABLE 16 HERE]

[TABLE 17 HERE]

[TABLE 18 HERE]

FOODSECURE
FOR POLICIES THAT MATTER

The FOODSECURE project in a nutshell

Title	FOODSECURE – Exploring the future of global food and nutrition security
Funding scheme	7th framework program, theme Socioeconomic sciences and the humanities
Type of project	Large-scale collaborative research project
Project Coordinator	Hans van Meijl (LEI Wageningen UR)
Scientific Coordinator	Joachim von Braun (ZEF, Center for Development Research, University of Bonn)
Duration	2012 - 2017 (60 months)

Short description

In the future, excessively high food prices may frequently reoccur, with severe impact on the poor and vulnerable. Given the long lead time of the social and technological solutions for a more stable food system, a long-term policy framework on global food and nutrition security is urgently needed.

The general objective of the FOODSECURE project is to design effective and sustainable strategies for assessing and addressing the challenges of food and nutrition security.

FOODSECURE provides a set of analytical instruments to experiment, analyse, and coordinate the effects of short and long term policies related to achieving food security.

FOODSECURE impact lies in the knowledge base to support EU policy makers and other stakeholders in the design of consistent, coherent, long-term policy strategies for improving food and nutrition security.

EU Contribution	€ 8 million
Research team	19 partners from 13 countries

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