Implications of Farm Size and Staple Production on Rural and Urban Food Security and Dietary Diversity[†]

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Abstract

We investigate how the distribution of domestic staple crop production by smallholders and commercial farms influence staple prices, and the implications it has on food security and dietary diversity in rural and urban areas. Using three waves of the World Bank's Living Standards Measurement Survey (LSMS) data as well as data from other national sources in Ethiopia, we find that proportional shift towards commercial and large-scale farms of staple crops significantly decreases their prices in both rural and urban areas, which then increases dietary diversity. Previous literature has focused on commercialization and its implications for food security in rural areas. This paper contributes to the literature by including food security and dietary diversity in urban areas. Our findings provide governments and international organizations insights on how to consider contextual specificities when implementing programs and policies aimed at either sustaining smallholder farming or incentivizing commercialized farms, keeping in mind their implications for consumer welfare, food security, and diet.

Keywords: Smallholder, commercial, price elasticity, food security, dietary diversity

JEL Codes: Q11, Q18, O12

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The global agri-food system has undergone an immense transformation and continues to face challenges with rising incomes, urbanization, demographics, and lifestyle changes. Small-scale farming remains the backbone of the agrarian economy in many emerging economies. The efficiency of small farms, mostly under two hectares, relative to large commercial farms, has been a topic of considerable research and debate. Some argue that smallholder farming is more efficient relative to larger farms (Barrett et al., 2010; Gautam & Ahmed, 2019). At the same time, they are disadvantaged partly due to low technology adoption and input use usage due to credit constraints (Ali et al., 2014; Feder, 1985; Guirkinger & Boucher, 2008; Sial & Carter, 1996). Others contend that the commercialization of agriculture that spurred the economic growth in developed nations can have similar effects on smallholder farming in low-income countries (Collier & Dercon, 2014) and that larger farms have the potential of meeting the food demand of a growing urban population in the rise of expanding nonfarm sectors taking labor out of agriculture (Fan et al., 2015).

Against this backdrop of a longstanding debate previous research has also explored the relationship between agricultural production and its implications for the food security of rural agricultural households (Diao et al., 2012; Dillon et al., 2015; Maertens & Vande Velde, 2017). The implications of these studies on issues of food security are important for understanding issues on poverty, hunger, and malnutrition, which are more prevalent in rural areas of developing countries. However, little is known about the effects of transitioning from smallholder to commercial farms on the welfare and food security of non-farming urban consumers. The implications of increased production from large farmers for urban consumers are considerably important since a significant proportion of the population in urban areas are poor and primarily landless casual laborers without any subsistence agriculture for sourcing their food. Coupled with the recent structural transformation in the developing world that has been characterized by premature deindustrialization, the urban poor are equally, if not more, vulnerable to inflation and other shocks as are their rural counterparts.

A recent paper by Ma et al. (2021) theoretically compares the welfare effects of smallholder vs. commercialized farms on rural and urban consumers in developing economies. The authors address how productivity can affect the welfare of in-country consumers if the increased output is directed towards staple crops. Based on parameters from publicly available data and the literature, their simulations find that the welfare of urban households always improves, whereas the welfare of rural households almost always declines. At the same time, the sum of urban and rural households mostly increases, often by considerable amounts, leading to policy discussions around (re)distribution of welfare gains.

The objective of this paper is to empirically examine the implications of the changing patterns of staple production, due to changes in farm size's acreage and production, on the dietary diversity and food security of rural and urban consumers. In this paper, we aim to answer two research questions. First, what is the relationship between changes in small farm vs. larger farm staple crop production on output prices of staples? Second, how do the potential changes in output prices of staples affect the dietary diversity and food security status of urban and rural households?

Background

Previous Literature

In Sub-Saharan Africa, agriculture remains small scale, with low productivity, low input use, and largely dependent on family labor (FAO, 2015), and many government initiatives have often focused on sustaining smallholder farming with extension services that aim to increase their productivity and foster intensification (Spielman et al., 2010). Yet, these policies often fail to alleviate the credit constraints that smallholders often face in low-income countries. While most high-income countries have seen an increase in agricultural labor productivity relative to non-agricultural labor, farmers in Africa have not experienced the same benefits (Masters et al., 2018). Some argue that farms must be large enough in order to adopt technologies and produce market surpluses (Dorosh & Mellor, 2013) and that in many African countries, medium-scale farms will most likely become the dominant form of farming (Jayne et al., 2019).

The efficiency and productivity of small farms relative to large commercial farms have been an ongoing topic of considerable research and debate. Several studies find that smallholder farming is more efficient relative to larger farms (Barrett et al., 2010; Gautam & Ahmed, 2019; Hazell et al., 2010), leading to a sustained promotion of smallholder farming operations as a poverty-reduction strategy (Ma et al., 2021). And the same time, smallholders face significant challenges. They include: technology adoption and input usage due to inelastic demand for the farm product (Binswanger & von Braun, 1991), poor policies and institutions, inadequate infrastructure (Dorward, 2013; Pingali, 2007), high transactions costs, market failure (Barrett, 2008), concentrated downstream sector (Gupta et al., 2018), credit constraints (Ali et al., 2014; Feder et al., 1985; Guirkinger & Boucher, 2008; Sial & Carter, 1996), and information asymmetry (Courtois & Subervie, 2015; Mitra et al., 2018).

Both sides argue the merits of smallholder farming, however, often inadequately consider the interrelationship between agricultural and general economic development, i.e., off-farm employment, incomes, urban food demand, and food security. Recent work has started to address this by considering the transformation of farm sizes and operations. Upscaling farm size has been seen as an important means to the agricultural transformation process. The increasing factor and labor costs could lead to the emergence of larger farms (Bachewe & Minten, 2021) that have the potential of meeting the food demand of a growing urban population in face of expanding nonfarm sectors taking labor out of agriculture (Fan et al., 2015).

Ethiopia

Ethiopia has been undergoing a rapid structural transformation in recent decades with increasing incomes, urbanization, agricultural growth, and changing consumption patterns. Small-scale farming takes up around 90% of Ethiopia's agricultural sector and many of these farmers rely on rain-fed production systems. The country's agricultural sector has been rapidly growing in the past two decades due to an increase in the usage of modern inputs, land expansion, increased labor use, and an increase in total factor productivity (Bachewe et al., 2018). Staple foods remain an important aspect of people's diets in Ethiopia. For example, expenditure of staples in Ethiopia consists of 36% of the total national food consumption value but still accounts for 43% of the quantity consumed (Minten et al., 2020). Though dietary habits have been shifting, starchy staples still account for 71.6% of calories consumed per adult on average (Stifel & Hassen, 2020). Urban Ethiopian households continue to consume teff, a local staple crop, as a main source of carbohydrate in their diet even when the price of teff has increased (Alem & Söderbom, 2012). Others find that due to an increase in household income, the share of cereals in total food expenditure is decreasing, suggesting a shift towards more expensive food groups, such as animal protein (Worku et al., 2017). At the same time, Ethiopia has one of the lowest consumption of fruits compared to the rest of the world (Micha et al., 2015).

Agricultural intensification has been one of the contributing forces to increased agricultural production volumes (Bachewe et al., 2018). Between 2004/2005 and 2013/2014, Ethiopia's agricultural production has increased by seven percent in agricultural GDP, on average, primarily due to land area expansion (Schmidt & Thomas, 2020). Research has shown that for most crops, commercial farms in Ethiopia yield around 50% more than those by smallholders, except for teff and coffee (Ali et al., 2017). The five major cereal crops take up 73% of the total cultivated area in Ethiopia (CSA, 2021).

Conceptual Framework

Our conceptual framework is illustrated in Figure 1, where we describe the process of transition from smallholder to commercial products, and how the changes in production distribution would affect staple prices. The effects on food security and dietary diversity of rural and urban consumers will follow as a result of staple price changes assuming reasonably that prices would transmit impact from regions of production to other rural areas as well as urban centers in major cities.

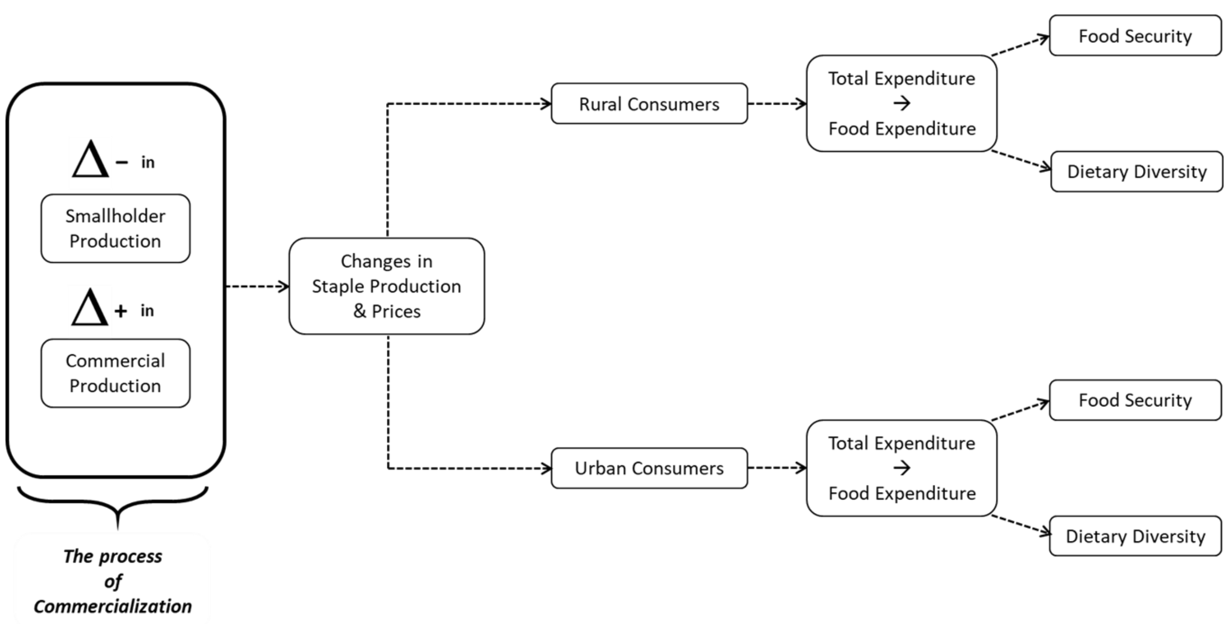

Figure 1: Conceptual Framework

We define “commercialization” as the process of transition from smallholder farming to commercial farm operations, for example, a decrease in smallholder production and an increase in larger-farm production. This process affects the production volume and accordingly, the prices of staple crops. The price change will affect the expenditure share of rural and urban consumers, leading to alterations in food consumption, dietary diversity, and food security outcomes. The consumer's response to price changes in a staple food is based on their relation to the prices of other items he or she purchases, and the consumer's budget or income (Dorward, 2012). A change in the price of food can either drive consumers to substitute within the same food group or to a different category of food (Skoufias et al., 2011).

Poor households tend to prioritize food that is denser in calories over the quality of food (Tefft et al., 2017) thus spending a considerable share of their income on staple foods (Mason et al., 2011). For example, in Zambia, though there is a trend towards changing diets, the share of staple crops remains high for those living in poverty (Mason & Jayne, 2009). In Niger, the lowest income quintile spends around 60% of their food budget on staples, compared to 44% for the highest-income quintile (Hollinger and Staatz, 2015). Furthermore, Alem and Soederbom (2018) find that urban Ethiopian households continue to consume teff, a local staple crop, as a main source of carbohydrate in their diet even when the price of teff has increased. In India, price elasticities are lower for richer households compared to poorer households (Kumar et al., 2011). Following the conceptual framework, we derive four hypotheses.

H1: Increased production of staples from the commercialization of farms, controlling for nationwide net imports, will result in a decline in the prices of staple foods.

H2: Assuming that staples are normal goods, through the substitution effect, the consumption of staples increases as they are not relatively cheaper than other foods.

Via the substitution effect, buyers will increase their consumption of the staple as its price is now relatively cheaper than other foods. For example, research by Skoufias et al. (2011) in Mexico reveals that given an increase in per capita expenditure, a large share of poor households substitutes within cereal groups, switching from cheaper to more expensive staples. In Malawi, increasing incomes are associated with higher demands for staples (Ecker & Qaim, 2011). Jensen and Miller (2008) find evidence of Giffen behavior in the Hunan province of China, where an increase in unearned income leads to a decrease in rice consumption. This negative income elasticity for the staple means that all of the income effect created by the price reduction goes to diversifying the diet.

H3: Via the income effect, consumers have an increase in buying power, increasing the consumption of staples, and the additional (real) income could be spent on other food items increasing dietary diversity.

A price decrease serves as an implicit increase in real income, enabling consumers to spend this extra "income" on other foods. For instance, in the Sahelian region of Africa, as net buyers of millet and sorghum, urban households suffered a fall in real income when prices of these staples increased (Haggblade et al., 2017). If the staple has a low-income elasticity compared to other food groups, then the income effect is small for the staple but larger for other food groups, such as fruits, vegetables, and animal proteins, which have greater income elasticities. In Kenya, food security and diet quality are improved through higher incomes gained through commercialization (Ogutu et al., 2019). In response to higher prices in starchy staples, consumers in West Africa respond by cutting back on diet quality, reducing consumption of fruits, vegetables, and animal protein (Hollinger and Staatz, 2015). Colen et al. (2018) find large differences in income elasticities among food groups in Africa with higher elasticities for animal protein and dairy compared to other food groups. When food expenditure increases, poorer households substitute their staple intake towards higher-quality foods (Skoufias et al., 2011).

H4: As urban households are predominately net food buyers, the effect of price reduction on expenditure patterns and dietary diversity would be higher for urban than for rural households.

Studies suggest that the majority of the urban poor devote a large share of their expenditure to staple food, thus, they become vulnerable when there is an increase in food prices (Ivanic & Martin, 2008). This implies that a price hike in staple food acts as a fall in income for urban inhabitants, then equally, a significant decrease in prices of staple goods would increase the purchasing power for the same group of people.

Data and Methodology

Data

From the World Bank's Living Standards Measurement Study's (LSMS) Ethiopia Socioeconomic Survey (ESS), we obtain household-level data on staple production based on farm size, staple prices, farm income, and our outcome variables, dietary diversity scores, and food insecurity. We utilize three waves of data from the years 2013/2014 (W2) 2015/16 (W3) and 2018/19 (W4). We exclude Wave 1 from our sample as it does not include data for urban households.

The ESS is nationally representative, covering more than 5,000 households in rural and urban areas based on a two-stage sampling methodology. The purpose of the ESS is to collect household panel surveys with an emphasis on linkages between agriculture and other parts of the economy (World Bank, 2014). ESS4 is not a follow-up of the previous three ESS waves. The main difference is in the coverage. It extends representation at a regional level additionally to rural and urban levels (World Bank, 2018). It was conducted in 565 enumerator areas (EA), where 316 are rural and 219 are urban. The datasets provide information on household characteristics, crop production, livestock ownership, food expenditure and consumption, and distance to basic services. The content changes do not affect the focus of our analysis.

Figure 2 shows the average price of the five staple crops corresponding to the three waves of LSMS data. We observe that prices of all five staples increased from 2013 to 2018. Among the five staples, teff yields the highest prices, and maize has the lowest prices.

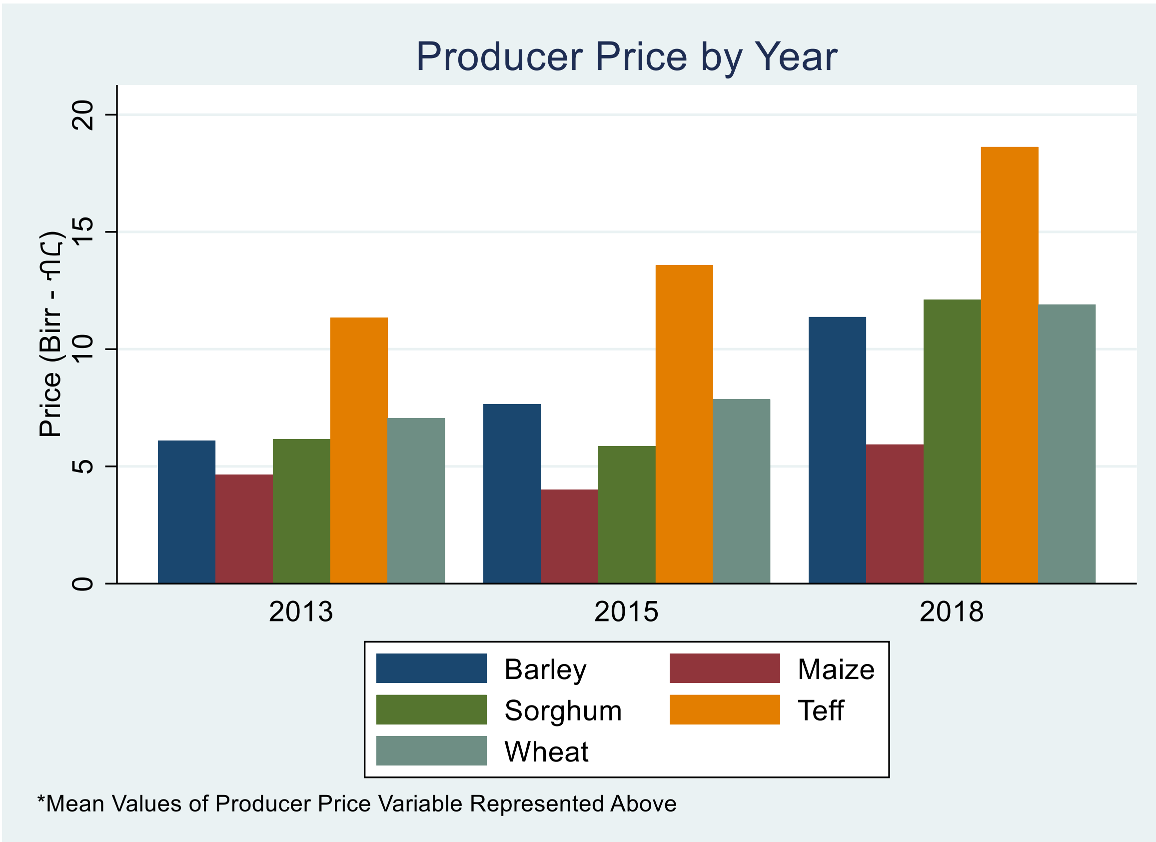

Figure 2: Average prices of staples from years 2013-2018 (Source: LSMS)

Tabes 1 shows the household expenditure of the twelve food groups, with the latter two columns separated into rural and urban areas. The food groups are used as measures of the dietary diversity index according to the FAO definitions (FAO, 2007). The tables show that households spend the largest share of their income on cereal, legumes, and spices groups. Urban households spend a larger share of income on cereals and meat whereas rural households' expenditure share is higher on legumes, spices, and vegetables. It's worth noting that expenditure shares for almost all food groups have decreased between Wave 3 and Wave 4 with the exception of cereals even though Figure 2 suggests that prices have increased between the two waves.

Table 1: Household Expenditure of the 12 Major Food Groups

Food Group	All Households			Rural Households			Urban Households		
	2013	2015	2018	2013	2015	2018	2013	2015	2018
Cereals	.244	.217	.284	.183	.171	.247	.35	.307	.315
White roots, Tubers	.273	.035	.029	.349	.037	.028	.143	.031	.03
Vegetables	.083	.201	.186	.094	.226	.202	.065	.154	.173
Fruits	.094	.012	.021	.106	.008	.008	.074	.02	.033
Meat	.089	.068	.055	.075	.051	.032	.112	.101	.074
Eggs	.039	.008	.007	.037	.005	.002	.041	.013	.011
Fish		.002	.002		.003	.001		.001	.003
Legumes, nuts	.016	.104	.087	.01	.107	.095	.027	.1	.079
Dairy	.008	.024	.025	.003	.016	.018	.017	.04	.03
Oils, Fats		.087	.083		.099	.102		.064	.067
Sweets	.021	.039	.045	.014	.043	.056	.032	.029	.036
Spices, etc.		.189	.16	.119	.224	.199	.111	.12	.127
N =	5262	4954	6770	3323	3272	3115	1939	1682	3655

Table 2: Mean Dietary Diversity and Months of Food Insecurity

Variable	2013[1]	2015	2018	2013	2015	2018	2013	2015	2018
	All Households			Rural Households			Urban Households		
Diet_Div	6.77	6.823	6.869	6.17	6.274	6.195	7.79	7.892	7.444
Food_Insec	.853	.887	.303	1.08	1.01	.412	.466	.649	.21

Table 2 presents the dietary diversity and food insecurity measures. Overall, urban households have higher levels of dietary diversity than rural households, by around one additional food group. We observe that the dietary diversity score increased for all households between 2013 and 2018, but have decreased for urban households. while the average months of reported food insecurity decreased by a larger margin between 2015 and 2018.

Empirical Specifications

To support our first hypothesis H1, the empirical specification in equation (1) below estimates farmer-reported price (of main staples) as the dependent variable as a function of total output sold as well as farm size controlling for farmer-specific covariates, access to markets, and time trend.

$$P_{it} = \beta_0 + \beta_1 Q_{it} + \beta_3 D_i + \beta_4 \boldsymbol{Z}_{it} + \beta_5 \boldsymbol{V}_{\boldsymbol{i}} + T_t + \varepsilon_{it} \qquad (1)$$

where P_{it} is the farmer-reported per-unit price of staple, Q_{it} is quantity sold, D_i is an indicator for a large-farmer (with greater than 4 hectares of land cultivated), a vector of farmer-specific covariates such as education and income captured by vector $\boldsymbol{Z}_{it}$, and access to market variables represented by $\boldsymbol{V}_i$; ε_{it} is the idiosyncratic error term. We estimate equation (1) using ordinary least squares. To check for robustness as well as potential endogeneity of quantity sold, we instrument that with farm size. The results appear in Tables 3 and 4. Equation (1) should not be interpreted as an inverse supply function since our objective is not to estimate the causal relationship between price and quantity, but instead to establish a correlation between the per-unit price of staple and farm size.

Second, we compute dietary diversity using the household dietary diversity score (HDDS), a qualitative measure of food consumption that represents a household's access to different food groups (FAO, 2007), which consists of a total of 12 food groups. We utilize the Food Insecurity Experience Scale (FIES) to measure households' experiences of access to food.

The basic model of our estimation strategy is as follows:

$$DD_{jt} = \beta_0 + \beta_1 P_{ts} + \beta_2 \boldsymbol{W}_{jt} + \varepsilon_{jt} \qquad (2)$$

where $DD_{jt}$is the dietary diversity outcome variable for household j in year t, P_{ts} is the price of staple crop s, $\boldsymbol{W}_{it}$ represents a vector of control variables on a household level, and ε_{it} is a random error term. The control variables of location, distance to markets, and farm-related incomes are included in the estimation for rural households but excluded for urban households. The price variables for sorghum and barley are dropped due to the noisiness in the data. The estimation for food insecurity uses the same specification.

Results

Tables 3 and 4 present the OLS and IV regression results of equation (1), respectively. Controlling for farmer characteristics, access to markets, and time fixed-effects, we find that larger farms (more than 4 hectares) receive lower prices per kilogram of their staple. The effects are significant for maize, teff, and sorghum in our OLS estimation (see Table 3 columns (1), (2), and (3)), and significant for teff and sorghum in our IV estimation (see Table 4 columns (1) and (2)). In Table 3, we control for the amount of staple sold by the farmer, which is instrumented by farm size in Table 4.

Table 3. Ordinary Least Squares Estimation of Equation (1)

	Maize	Teff	Sorghum	Wheat
Quantity sold	-0.00175***	-0.0193***	-0.00222**	-0.00130*
	(0.000328)	(0.00312)	(0.00111)	(0.000672)
Dummy for large-farm	-0.673*	-3.544***	-5.119***	0.482
	(0.376)	(1.246)	(1.013)	(0.544)
N	454	704	266	257
R^2	0.291	0.304	0.444	0.262
Time Fixed Effects	Yes	Yes	Yes	Yes
Market Access Variables	Yes	Yes	Yes	Yes
Farmer-level covariates	Yes	Yes	Yes	Yes

The dependent variables are per-kilogram farmer-reported price of the staple. Time fixed effects are for waves 3 and 4 holding wave 2 as the benchmark case. Market access variables include distances to road, Woreda, urban center, weekly market, and if a market is available in the village or not. Farmer-level covariates include years of education and farmer income. Standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.010

Table 4. Instrumental Variables Estimation of Equation (1)

	Maize	Teff	Sorghum	Wheat
Quantity sold	-0.00185	-0.00565	-0.0273	0.0109
	(0.00231)	(0.00974)	(0.0198)	(0.00949)
Dummy for large-farm	-0.636	-4.835***	-3.682***	-1.389
	(0.886)	(1.289)	(1.287)	(1.661)
N	454	266	704	257
R^2	0.291	0.423	0.298	.
Time Fixed Effects	Yes	Yes	Yes	Yes
Market Access Variables	Yes	Yes	Yes	Yes
Farmer-level covariates	Yes	Yes	Yes	Yes

Quantity sold is instrumented by farm size. The dependent variables are per-kilogram farmer-reported price of the

staple. Time fixed effects are for waves 3 and 4 holding wave 2 as the benchmark case. Market access variables include distances to road, Woreda, urban center, weekly market, and if a market is available in the village or not. Farmer-level covariates include years of education and farmer income. Standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.010

First, note that we find negative significant effects (in OLS) of quantity sold on staple prices, which as discussed earlier, do not suggest a negative supply curve. The significance on quantity sold is lost in the IV regressions although the negative sign holds for all the crops except for wheat. Second, the results do not indicate any loss of bargaining power with large-scale production, but the fact that controlling for farmer characteristics and access to markets, market equilibrium over time for large-scale farming is most likely possible with lower staple prices due to scale or other idiosyncratic effects (unobservable to the econometrician) than smallholders.

Our estimates indicate that large farmers receive about 3.5 to 5.1 birr per kilogram less than smallholder farmers. Given the trend of transition from small-scale to large-scale production, this finding supports *H1* that prices of staples decrease as farm size increases.

Tables 4 and 5 show the results from our estimation for the effect of staple crop prices on the dietary diversity and months of self-reported food insecurity, respectively. These results compare wave 2 to waves 3 and 4 of the LSMS survey. Columns 1 and 4 show the results for wheat prices only; the estimations with the addition of maize price and teff price are shown in the remaining columns.

From Table 4, we observe that dietary diversity increases with maize and wheat price increase, but decreases with teff price, in both locations. Dietary diversity increased in Wave 3, with a larger magnitude in urban households. The increase is to a lesser degree in Wave 4, with similar increases between rural and urban households. Interestingly, household size increases dietary diversity in both types of households.

The results show more of a variation between rural and urban households in the months of reported food insecurity. For rural areas, food insecurity does not change with an increase in the price of staple crops (maize, wheat, and teff). One possible explanation for obtaining an insignificant impact of increased staple prices on food insecurity in rural areas is that farming households are likely to be net sellers of staples. Consequently, they remain unaffected because they have a positive marketed surplus. However, food insecurity increases when the prices of maize and wheat price increase while urban food insecurity decrease when teff price decrease. For urban households, food insecurity increased in Wave 4, while rural households experienced a decrease. In Wave 4, the months of food insecurity decreased. Furthermore, food insecurity decreases with the number of household members in rural while no influence is observed for urban households.

For rural households, having a market nearby is associated with decreased food insecurity. Our results show that for most households, a price increase in wheat and maize increases dietary diversity while increasing food insecurity. Conversely, an increase in teff prices yields opposite effects. None of the income variables appears to have a large impact on both dietary diversity and food insecurity.

Table 4: Dietary Diversity by Rural and Urban Households

Dependent Variable:	*Rural Households*			*Urban Households*		
Dietary Diversity	(1)	(2)	(3)	(4)	(5)	(6)
Wheat price/kg	-0.00748	-0.00785	21.88***	0.000872	-0.0000618	12.43***
	(0.00674)	(0.00674)	(2.066)	(0.00512)	(0.00516)	(1.995)
Distance to road	-0.000158	-0.0000299	-0.000536			
	(0.000944)	(0.000946)	(0.000923)			
Distance to Woreda	-0.00710***	-0.00707***	-0.00458**			
	(0.00209)	(0.00209)	(0.00205)			
Distance to Urban Center	0.000354	0.000357	0.000388			
	(0.000631)	(0.000631)	(0.000615)			
Market_yes	-0.0758	-0.0739	-0.0912			
	(0.107)	(0.107)	(0.104)			
Distance to Weekly Market	-0.00107	-0.00175	-0.00105			
	(0.00408)	(0.00410)	(0.00400)			
Per capita income	0.0000201	0.0000197	0.0000166	2.19e-08	1.06e-08	-0.000000120
	(0.0000161)	(0.0000161)	(0.0000157)	(0.000000631)	(0.000000631)	(0.000000628)
Crop income	0.0000399***	0.0000390***	0.0000360***			
	(0.0000105)	(0.0000105)	(0.0000102)			
Nonfarm income	-0.00000252	-0.00000259	-0.00000215	1.27e-08	1.53e-08	3.99e-08
	(0.00000380)	(0.00000380)	(0.00000370)	(0.000000126)	(0.000000126)	(0.000000125)
Farm income	0.00000217	0.00000254	0.00000110			
	(0.00000909)	(0.00000909)	(0.00000886)			
Household size	0.0826***	0.0834***	0.0632***	0.259***	0.256***	0.247***
	(0.0157)	(0.0157)	(0.0154)	(0.0158)	(0.0158)	(0.0158)
Wave 3	1.352***	1.344***	1.328***	1.440***	1.441***	1.449***
	(0.0805)	(0.0806)	(0.0786)	(0.0809)	(0.0809)	(0.0804)
Wave 4	0.877***	0.881***	0.884***	0.846***	0.844***	0.849***
	(0.105)	(0.105)	(0.103)	(0.0820)	(0.0820)	(0.0816)
Maize price/kg		-0.0260*	12.76***		0.0243	7.285***
		(0.0149)	(1.207)		(0.0171)	(1.165)
Teff price/kg			-5.295***			-3.007***
			(0.500)			(0.483)
N	2104	2104	2104	3658	3658	3658
R^2	0.190	0.192	0.233	0.148	0.149	0.158

Standard errors in parentheses * p<0.10, ** p<0.05, *** p<0.010

Table 5: Food Security by Rural and Urban Households

Dependent Variable:	*Rural Households*			*Urban Households*		
Food Insecurity	(1)	(2)	(3)	(4)	(5)	(6)
Wheat price/kg	0.00251	0.00328	2.587	-0.0167***	-0.0182***	4.134***
	(0.00671)	(0.00669)	(2.104)	(0.00360)	(0.00363)	(1.406)
Distance to road	-0.00177*	-0.00204**	-0.00210**			
	(0.000939)	(0.000939)	(0.000940)			
Distance to Woreda	0.00328	0.00322	0.00351*			
	(0.00208)	(0.00208)	(0.00209)			
Distance to Urban Center	-0.000246	-0.000252	-0.000249			
	(0.000628)	(0.000626)	(0.000626)			
Market_yes	-0.259**	-0.263**	-0.265**			
	(0.107)	(0.106)	(0.106)			
Distance to Weekly Market	-0.00212	-0.000690	-0.000607			
	(0.00406)	(0.00407)	(0.00407)			
Per capita income	-0.0000159	-0.0000152	-0.0000155	3.85e-08	2.07e-08	-2.29e-08
	(0.0000160)	(0.0000160)	(0.0000160)	(0.000000443)	(0.000000443)	(0.000000443)
Crop income	-0.0000145	-0.0000127	-0.0000131			
	(0.0000104)	(0.0000104)	(0.0000104)			
Nonfarm income	0.00000102	0.00000114	0.00000120	-1.18e-08	-7.78e-09	4.65e-10
	(0.00000378)	(0.00000377)	(0.00000377)	(8.84e-08)	(8.83e-08)	(8.83e-08)
Farm income	-0.00000250	-0.00000327	-0.00000344			
	(0.00000904)	(0.00000902)	(0.00000902)			
Household size	-0.0343**	-0.0359**	-0.0383**	-0.00133	-0.00515	-0.00840
	(0.0156)	(0.0156)	(0.0157)	(0.0111)	(0.0111)	(0.0112)
Wave 3	-0.173**	-0.157*	-0.158**	0.165***	0.167***	0.170***
	(0.0801)	(0.0800)	(0.0800)	(0.0568)	(0.0568)	(0.0567)
Wave 4	-0.656***	-0.665***	-0.664***	-0.165***	-0.168***	-0.167***
	(0.105)	(0.105)	(0.104)	(0.0576)	(0.0576)	(0.0575)
Maize price/kg		0.0546***	1.564		0.0381***	2.463***
		(0.0148)	(1.229)		(0.0120)	(0.822)
Teff price/kg			-0.625			-1.004***
			(0.509)			(0.340)
N	2104	2104	2104	3658	3658	3658
R^2	0.034	0.040	0.041	0.015	0.018	0.020

Standard errors in parentheses * p<0.10, ** p<0.05, *** p<0.010

Conclusions

In this paper, we explore the implications of the changing patterns of staple production due to changing patterns of production due to small versus larger farms' acreage and production on the dietary diversity and food insecurity of rural and urban households. This paper extends the debate on the inverse size productivity of farms by assessing its relationship to urban and rural consumers' dietary habits. We assessed the relationship between changes in small farm vs. larger farm staple crop production on output prices of staples, and how the changes in prices affect the dietary diversity and food security status of urban vs. rural households. Using three waves of survey data from the World Bank's LSMS, our preliminary results show that prices of staples decrease as farm sizes increase.

We further find that the dietary diversity of both rural and urban households increases when the price of maize and wheat rises; the opposite result is observed with teff prices. The increase in the prices of maize, wheat, and teff does not affect household food insecurity in rural areas. Urban household food insecurity increases when the prices of wheat increase, but decreases when teff and maize prices increase.

Focusing our analysis on maize, teff, and wheat appears to be plausible as the Ethiopian government has been making public investments to increase the overall domestic production of the respective three crops (Benson et al., 2014). Our results contrast with the same authors, who find that an increase in teff production leads to the largest relative welfare increase for urban households, while maize production increase benefits rural households the most. Our findings are contrary to that of Wang and Çakır (2021), who find that an *increase* in teff prices *reduces* overall consumer welfare in terms of dietary diversity and food insecurity. The impact is larger for urban households as they consume larger amounts of teff.

Understanding the relationship between farm size production, food prices, and household dietary diversity has many relevant policy implications. Our findings provide governments and international organizations insights on how to consider contextual specificities when implementing programs and policies aimed at either sustaining smallholder farming or incentivizing commercialized farms, keeping in mind their implications for consumer welfare, food security, and diet.

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