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Emerging medium-scale tenant farming, gig economies, and the COVID-19 disruption

Evidence from commercial vegetable clusters in Ethiopia

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ABSTRACT

Driven by the fast spread of private irrigation pumps, there has been a rapid expansion of intensive vegetable cultivation in the central Rift Valley in Ethiopia, making it the most important commercial vegetable production cluster in the country. Supporting that “quiet revolution” has been an inflow of migrant laborers – paid through daily, monthly, or piecemeal contracts, with few employment benefits attached to them – and a gig economy as widely-used contractors organize, among others, mechanized land preparation, the digging of wells and ponds, seedling propagation, and loading of trucks. Almost 60 percent of the irrigated area is cultivated by medium-scale tenant farmers relying on short-term rental contracts. It seems that gig economies characterized by flexible contract arrangements implemented by outside contractors, which are increasingly fueling sophisticated sectors in developed countries, are important in these commercial agrarian settings in Africa as well. We further find that the COVID-19 pandemic has led to significant disruptions of this model, as seen by more limited access to services and the unavailability or high price increases in factor markets, especially for labor. We further note large but heterogenous price changes in output markets. The pandemic seems especially to have had important effects on the medium-scale tenant farmers as they depend relatively more than smallholders on outside inputs, labor markets, and these gig economies. However, on the other hand, they benefit more than smallholders from favorable output markets for vegetables.

1. INTRODUCTION

Driven by improved connectivity and the spread of the internet, labor relationships are changing and gig economies are becoming more important in a number of sectors in developed countries, leading to a heated debate on disadvantages and benefits for workers and consumers (De Stefano 2015; Aloisi 2015). Friedman (2014) describes this workplace as follows: *“A growing number of American workers are no longer employed in ‘jobs’ with a long-term connection with a company but are hired for ‘gigs’ under ‘flexible’ arrangements as ‘independent contractors’ or ‘consultants,’ working only to complete a particular task or for defined time and with no more connection with their employer than there might be between a consumer and a particular brand of soap or potato chips.”* (Friedman 2014, p. 171). While such gig economies are widely studied in developed countries, little research, however, has been done on this in developing country settings, especially so in agricultural and rural economies.

Agricultural economies are rapidly transforming in developing countries (Reardon et al. 2019). This is also the case in Africa where increasing urbanization, population growth, income growth, policy reform, and better road and communication infrastructure are leading to a ‘quiet revolution’ in food systems (AGRA 2019). These changes have enormous implications on the way that agriculture is done and on how food and agricultural markets function. For example, while smallholder agriculture has been a defining characteristic for most of Africa, there is now increasing evidence in a number of countries on the emergence of medium- and large-scale farmers who increasingly see potential in agriculture as a source of profits and livelihoods, as these farmers satisfy rapidly growing urban demand and benefit from urban residents increasing ability and willingness to pay for food (Jayne et al. 2016, 2019; Sitko and Jayne 2014). Although there is an emerging literature on these larger-scale farmers, few authors have looked at their link with rural transformation processes overall, their role in reshaping rural economies through service and labor contracts, and the possibly important spillovers of this agricultural transformation on these economies more broadly.

We focus on the case of commercial vegetable clusters in Ethiopia. This is an interesting case for a number of reasons. First, Ethiopia has seen rapid growth in its cereal economy (Bachewe et al. 2018), but it is unclear what has been happening in its horticultural sector where production growth is much desired as diet diversity is low in the country and prices are rapidly increasing, making vegetables often unaffordable, especially for the poor (Bachewe and Minten 2019; Hirvonen et al. 2018). The perception is that few changes have happened in this sector, seemingly because transformation is harder to achieve for these crops given more difficult growing – due to pest and diseases – and marketing requirements – due to their perishability. Second, job creation is high on the agenda of policy makers, locally and internationally (e.g. IFAD 2019; Mueller and Thurlow 2020). It is therefore relevant to study job creation in these commercial clusters and the type of labor markets and service contracts that are emerging in these agrarian and rural economies. Third, cluster-based development has shown important successes in countries such as China (e.g. Zhang and Hu 2014), and these models are increasingly being promoted elsewhere, including Ethiopia (Diriba and Man 2019). However, there is little evidence to date on how this is playing out in practice and what the implications of such developments are on related sectors.

Moreover, we look at how these commercial vegetable clusters have been affected by the COVID-19 pandemic. On 13 March 2020, the first COVID-19 case was confirmed in Ethiopia. Three days later, the government closed schools, banned all public gatherings, and recommended social distancing. Other measures to contain the spread of the virus soon followed. Travelers from abroad were put into a 14-day mandatory quarantine and travel through land borders was prohibited. Several regional governments banned all public transportation and imposed restrictions on other vehicle movement between cities and rural areas (these restrictions were relaxed later). While these actions were expected to slow the spread of the virus, they may have had substantial effects on food value chains (Tamru et al. 2020). However, there has to date not been any empirical and representative assessment.

Based on a large vegetable producer survey fielded in January and February 2020, we show – driven by increasing urban demand and the fast spread of irrigation through the use of private pumps – a rapid increase over the last decade in vegetable production in the central Rift Valley in Ethiopia, making it the most important commercial vegetable cluster in the country and the major supplier of vegetables to Addis Ababa, Ethiopia's capital. We note important spatial spreads in irrigation uptake – more than a doubling of land under irrigation in the off-season – and wide use of improved imported seeds, of agro-chemicals, and of fertilizers, mostly obtained from private agro-dealers. Linked with this and with improved communication being available, we note the emergence of a service economy with flexible contracts delivering different types of services. Contractors organize the digging of wells and ponds, seedling propagation, spraying, mechanized land preparation, harvesting, and loading of trucks. Medium-scale tenant farmers cultivate almost 60 percent of this irrigated land, relying on relatively short-time rental contracts. These medium-scale farmers cultivate almost 5 hectares of vegetables, which is relatively small for international standards, but their productivity is high with the annual value of their produce estimated at 52,000 USD, 60 times Ethiopia's GDP per capita. We further see an inflow of laborers into the region, paid through daily, monthly, or piecemeal contracts, but with little employment benefits – such as health services – beyond their salaries. Gig economies, which are increasingly important for service sectors in developed countries, are shown to have emerged quickly in the case of this commercial agrarian sector in Ethiopia as well.

In a follow-up survey with the same vegetable producers three months later (May 2020) – after the start of the social and economic disruptions linked to the COVID-19 pandemic – we find that the input markets, agricultural service provision, and labor markets that have been fueling this agricultural transformation in vegetable production in the central Rift Valley, have been significantly

and negatively affected by the COVID-19 crisis. Because of a disruption in logistics, the majority of farmers report problems in accessing these markets and services. Especially labor markets have been most dramatically impacted – the lack of access to daily labor together with rapidly increasing wages in the major producing areas is leading to a significant disruption in normal production patterns. Moreover, access to fertilizers and agro-chemicals has become more difficult, the latter linked to land border closings, which have blocked (sometimes illegal) imports from neighboring countries, and to reduced imports from China where supply chains have been affected. Half of the farmers estimate that yields during this production cycle would already be lower than typical during the same period in a normal year.

This COVID-19 related disruption seems especially to have had an effect on the larger medium-scale tenant farmers as they depend more heavily than smallholders on these gig economies. They rely less on family labor and more on labor markets, they are more involved than smallholders in labor-intensive and risky vegetable crops, and they use these service economies more intensively. On the other hand, medium-scale tenant farmers mostly benefited from price increases in output markets, while the crops grown by smallholders saw price decreases. Some of the local price increases for vegetables can be linked to a reduction of vegetable imports from other countries, which typically play a stabilizing role in local markets. Overall, we note heterogeneous effects at the farm level on income changes after the COVID-19 pandemic: while about 60 percent of the vegetable farmers indicated that incomes were lower than normal for the time of the year, 28 percent indicated similar levels, and 12 percent saw an improvement in income.

These findings do not bode well for the future of this important sector, and they lead to a number of implications.

- The upscaling process and the ongoing transformation in rural areas have helped to deliver more and higher-quality vegetables to the growing urban market and beyond, which is important for nutrition in Ethiopia as consumption of vegetables and desired diet diversity is low. That process has clearly been disrupted.
- Access to improved hybrid seeds and agro-chemicals, important to achieve high yields, was already difficult pre-COVID-19, often linked to cumbersome red tape but also due to foreign exchange shortages (World Bank 2019). The effect of the COVID-19 pandemic on the decline in export earnings and economic growth in the country might have exacerbated this situation and might have led to a further deterioration of Ethiopia's trade balance and foreign exchange situation, complicating this access to crucial inputs.
- Given cost changes and problems in accessing agricultural inputs, labor, and services due to COVID-19, farmers are facing higher production costs. These might affect incentives for growing vegetables and also eventually impact the availability, overall market pricing, and the affordability of vegetables in Ethiopia.
- Finally, the importance of these commercial clusters in food systems is often not well understood. They are typically missed in national data collection systems, as the period of production during a new irrigation season and highly localized agricultural specialization are not well captured with nationally representative samples. Better information and monitoring of such important commercial clusters as to better inform decision making is therefore called for.

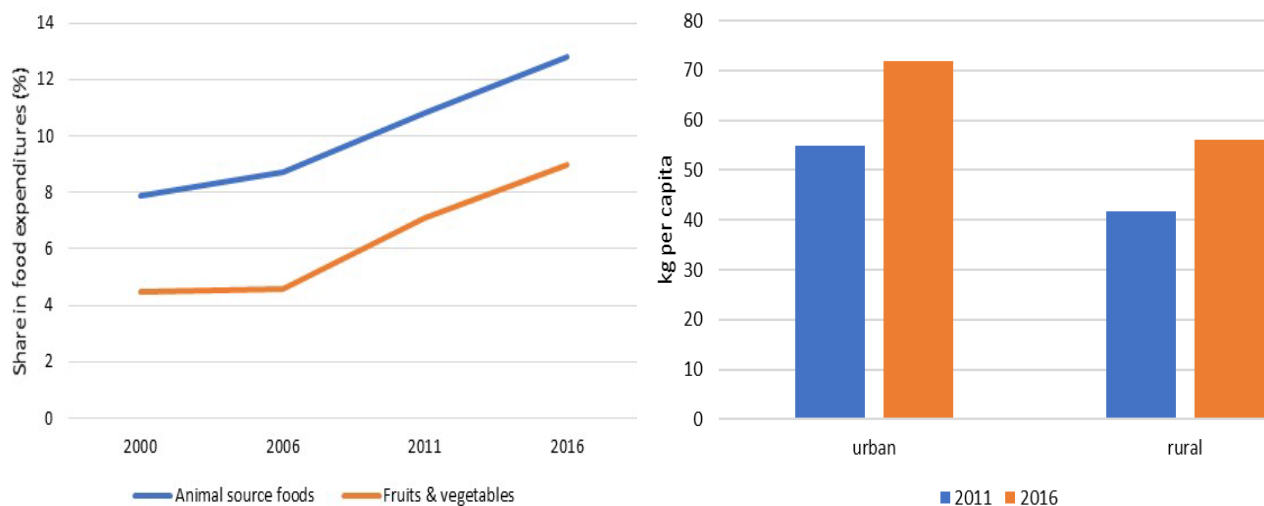
2. BACKGROUND

Ethiopia's agricultural economy has been rapidly transforming over the past 20 years, driven by increases in income, urbanization (and the increasing food demand from the relatively richer consumers in these cities), improved road and communication infrastructure, and a pro-active

government committed to agricultural and rural growth (Dorosh and Minten 2020, Bachewe et al. 2018). Most of the changes, however, have happened in the cereal sector. Transformation in the high-value and nutritious food sectors is lagging behind, as illustrated by their rapidly increasing prices, seemingly driven by increasing demand outstripping supply, at least at the national level (Bachewe and Minten 2019).

We focus in this paper on the case of vegetables in particular. Consumption levels of vegetables in Ethiopia are low. This is associated with low diet diversity in the country as a whole, one of the major causes of poor national nutritional indicators (Baye and Hirvonen 2020). However, changes are noted in consumption of vegetables in the most recent periods for which data are available. Figure 2.1, based on the nationally representative Household Consumption and Expenditures Surveys (HCES), shows increasing consumption of vegetables as a share of the overall food budget and increasing quantities of vegetables being consumed in both urban and rural areas over time. Figure 2.1 also shows that the quantities consumed in urban areas are significantly higher than in rural areas.

Figure 2.1: Consumption of vegetables in Ethiopia



Source: Authors' calculations based on HCES.

In the case of Addis Ababa, Wolle et al. (2020) find that 19 percent of the food budget of city residents was devoted to vegetables in 2020, significantly higher than national levels (Figure 2.1). These vegetables are mostly procured from areas such as the Central Rift Valley. Results from the survey presented below show that almost three-quarters of the four main vegetables in Addis Ababa were procured from that area at the time of the survey. The emergence of the Central Rift Valley for vegetable cultivation is seemingly due to a number of reasons. First, there are a number of lakes (e.g. Lake Ziway, Koka Lake) from which water can be easily used for irrigation. Soils around other lakes in Ethiopia often suffer from high salinity or difficult topography (steep shores) that inhibit their use for irrigated agriculture. Where there is no access to a lake, there is also the potential of river irrigation and groundwater levels in the Central Rift Valley are good in general. Second, the area is located on a good road a three-hour drive from Addis Ababa, allowing for reasonably good market access to the biggest city in the country. A number of major secondary cities – Hawassa, Debre Zeyt, and Adama – are also close by. Third, the region is part of the sub-tropical semiarid agro-climatic zone, which is well suited for vegetable cultivation when irrigation water is available.

3. DATA AND METHODOLOGY

To understand transformation processes in this commercial cluster and the disruption to the cluster caused by the COVID-19 crisis, two rounds of surveys were implemented. In the first round done in late January and in February 2020, 810 farmers were interviewed. The sample was set up as follows. We collected information on all the irrigated areas where vegetables are cultivated in the East Shewa zone of the Central Rift Valley. These areas include the woredas of Dugda, Adama Tuli, Bora, and Lume. We selected those kebeles in these four woredas that had more than 100 hectares of irrigated land. In each kebele, a list was made of all vegetable cultivators, listing the irrigated area per cultivator and assessing if the land was rented in. Those cultivators that rented in more than 0.5 hectares were considered 'medium-scale tenant farmers'. In each kebele, 22 farmers were interviewed. One-quarter of the farmers interviewed were randomly selected from the medium-scale farmers list and three-quarters from the list of smallholders producing vegetables under irrigation. A community questionnaire was fielded in each kebele as well.

After the selection of the sample households, a comprehensive household survey was fielded in which information was collected on household characteristics, income generating activities, assets, and details on vegetable activities. Notably, recall questions are strongly relied upon in the analysis. The recall questions focused on main changes in the business of vegetable producers and, therefore, concerned issues that likely were easy to remember. Nonetheless, we acknowledge that such recall questions are prone to measurement error (De Nicola and Giné 2012, de Weerd et al. 2015). The recall results are therefore only used in descriptive analyses to describe broad transformation patterns.

The second-round survey done in May 2020 was a phone survey, in which we sought to understand the impact of the COVID-19 crisis on these vegetable farmers. Given the more complicated implementation and short duration phone connections with survey respondents, mostly qualitative questions were asked in this second survey. The questions focused on problems in input markets, access to services, labor markets, output markets, income changes, behavioral changes because of COVID-19, and on plans for the future. We also collected information on prices in input and output markets. While all medium-scale tenant farmers from the first round were targeted for the phone survey, about half of the smallholder farmers of the first round were randomly selected for the second survey round. In total, 505 households were reached by phone and the complete interview was administered to 433 of them (72 farmers were not growing any of the key vegetables at the time of the May survey, so were not interviewed).

4. PATTERNS OF TRANSFORMATION

4.1. Vegetable production

In Table 4.1, we report major trends in vegetable cultivation in the surveyed villages based on data obtained from community focus groups in the first round of the survey. The area cultivated in the rainy season did not change very much over the last decade. However, we see more than a doubling of the area under irrigation, from 215 to 469 hectares per kebele (village) on average. Because of this irrigation, about one-third of the land in these kebeles is cultivated more than once, although more frequent cultivation is still relatively rare (2 percent of the land is cultivated three times and 5 percent is used for perennial crops, usually papayas). This area under irrigation is almost exclusively used for vegetable cultivation, as focus groups in these kebeles indicated 95 percent of that area used for that purpose. However, some of the land during the main rainy

season (the Meher season) is also used for vegetable cultivation (about 20 percent, with little change seen over the last decade).¹

The most important vegetables grown in the survey area are tomato and onions, with 33 and 31 percent of the area allocated to these two crops, respectively. Cabbage, green pepper, and Ethiopian kale are estimated to be grown on 8, 8, and 9 percent of the land, respectively. Other crops make up 12 percent. Focus groups were also asked about average yields at the time of the survey and ten years earlier. We see that yields improved if not much, increasing between 5 and 15 percent. It is worth noting the high yield levels that are reached for these vegetables. For example, yields for tomatoes (65 tons/hectare) are more than 10 times the level of the best performing cereal (maize) in the country. These numbers also allow us to assess the importance of this cluster for the supply of vegetables at the aggregate level. Doing back-of-the-envelope estimates,² we estimate that the value of production from this commercial cluster is approximately 200 million USD, close to the value of the much-heralded flower exports from Ethiopia.

Table 4.1: Growth in vegetable production

		Ten years before survey	At survey
Area			
Total area cultivated			
a. In rainy season	hectares	1,279	1,144
b. In irrigation season	hectares	215	469
Share of area for vegetables in			
a. In rainy season	%	19.3	21.4
b. In irrigation season	%	80.3	94.8
Share of cropland in village that is cultivated			
a. ... once a year	%	78.0	66.2
b. ... cultivated twice a year	%	16.6	26.5
c. ... cultivated thrice a year	%	1.5	2.4
d. ... permanently (perennial crops such as fruit trees)	%	4.0	5.0
Total	%	100.0	100.0
Crop information			
Of all vegetables grown, what is their importance area wise (mean)?			
a. Tomato	%	31.4	32.6
b. Onion	%	27.9	30.6
c. Cabbage	%	8.0	8.1
d. Green pepper	%	10.2	7.6
e. Ethiopian kale	%	11.8	8.9
f. Others	%	10.7	12.3
Total	%	100.0	100.0
Average yields (mean)			
a. Tomato	tons/ha	56.60	65.10
b. Onion	tons/ha	30.60	31.84
c. Cabbage	tons/ha	37.66	40.89
d. Green pepper	tons/ha	25.10	26.44
e. Ethiopian kale	tons/ha	58.58	64.62

Source: Community survey.

These data indicate that there have been significant changes in vegetable production in this commercial cluster over the last decade, making it the most important vegetable producing cluster in the country and the major supplier of vegetables to the city of Addis Ababa and beyond. The

¹ Vegetable cultivation was often deemed more complicated and costly during the rainy season because of higher disease incidence.

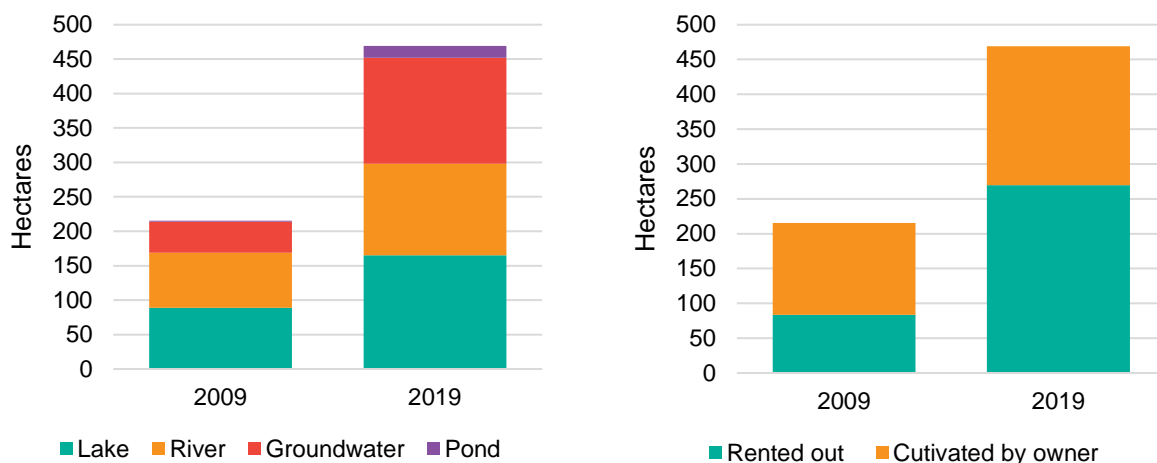
² Using average prices at the time of the survey, average reported yields, similar yields and prices as green pepper (the vegetable with the lowest yields and prices of the four main vegetables) for "other vegetables", and one harvest a year.

biggest contributor to the increase of vegetable production has been area expansion during the irrigation season from September to May, when rains are limited. These changes in vegetable production – as well as the increasing intensification in land use – have not been well documented. However, these findings are clearly important for the transformation agenda in Ethiopia and in Africa more broadly, as transformation in the domestic horticultural sectors has not been well understood. We next focus on two important factors linked to this “quiet revolution”, i.e. access to irrigation that allowed for this area expansion, and the active use of rental markets. Afterwards, we discuss changes in input markets which enabled the high land productivity.

4.2. Irrigation and land rental markets

Irrigation can lead to major changes in agricultural economies in developing countries.³ In Ethiopia, the majority of agricultural production is rainfed. The importance of irrigation is relatively minor and localized (Mulat 2011), although it recently has received more emphasis from government and development partners alike (Dorosh and Minten 2020). The increase in irrigated area has been linked with different types of irrigation, i.e., river, lake, pond (where water harvesting is practiced), and groundwater irrigation. Figure 4.1 shows that lake, river, and groundwater irrigation are almost equally important, while pond irrigation is still at low levels.

Figure 4.1: Share of vegetable land irrigated and rented, 2009 and 2019



Source: Authors' calculations from community survey.

The share of groundwater irrigation, specifically, increased over the decade studied by more than 11 percentage points, leading to a 240 percent increase in the area under groundwater irrigation. Improved access to and availability of private pumps have played a major role in this expansion of irrigated areas. Almost three-quarters of the pumps used by these farmers were pumps owned by farmers themselves. That is in contrast to a decade earlier when private pumps owned by farmers themselves only made up 46 percent of the pumps used. The pumps that are found in the market are mostly imported from China. Private pumps are now more readily available, and there is more competition and choice (Table 4.2).

³ Hossain (2009) for example has shown how it has affected in a major way the way that rice cultivation is done in Bangladesh and how the availability of cheap pumps allowed for a doubling of the country's rice output.

Table 4.2: Change in use of irrigation pumps in vegetable production over past 10 years

		Ten years before survey	At survey
Share of irrigated land:			
a. Private pumps owned by farmers themselves	%	45.7	72.6
b. Private pumps owned by somebody else	%	18.7	11.5
c. Communal pumps	%	20.8	9.4
b. No pumps - gravity irrigation	%	14.9	6.5
Total	%	100.0	100.0
Private pumps			
Pumps from:			
a. China	%	59.5	75.7
b. India	%	10.8	5.4
c. Europe	%	16.2	13.5
d. Other (Japan)	%	13.5	5.4
e. Do not know	%	0.0	0.0
Total	%	100.0	100.0
There is choice in pumps to buy:			
a. No choice	%	24.3	2.7
b. Little choice	%	59.5	21.6
c. A lot of choice	%	16.2	75.7
Total		100.0	100.0

Source: Household survey.

Active land rental markets have been very important in this transformation as well. While land regulations in Ethiopia are often presumed not to be conducive for secure land rental arrangements (Holden and Ghebru 2016), this does not seem to have been a hindrance for its widespread use in these areas. A large number of medium-scale and capital-intensive farmers – sometimes coming from outside the region but increasingly from the woreda (district) itself – are renting in land to grow vegetables. It was estimated at the time of the survey that 57 percent of the vegetable land is cultivated by these medium-scale tenant farmers (Figure 4.1). Figure 4.1 further shows that the area cultivated by these medium-scale tenant farmers has been steadily increasing over time, more than tripling over the last decade.

Table 4.3: Land rental practices in vegetable production

		Mean
Have a written lease	%	89.2
Typical length of lease:		
a. One-season lease	%	35.1
b. One-year lease	%	64.9
c. Two-year or longer lease	%	0.0
Total	%	100.0
Price for agreement (mean)		
a. One-season lease	Birr/ha	10,908
b. One-year lease	Birr/ha	16,208
After land has been used by investors for vegetables, is land degraded?		
a. A lot	%	48.7
b. A bit	%	29.7
c. No different from other crops	%	21.6

Source: Household survey.

These tenant farmers typically rent in land based on short-term (written) leases. Of the medium-scale tenant farmers, 65 percent reported that they had leases for one-year, while the rest had it

only for one-season (Table 4.3). Surprisingly no longer-term leases were reported by any of these interviewees. The average price paid for a one-season lease is 10,908 Birr (340 USD) per hectare, a relatively small amount compared to the total value of output coming from such areas. For example, the average value of output from a hectare of tomatoes during that period would be around 10,000 USD.⁴

Table 4.4: Characteristics, medium-scale vegetable farmers versus smallholders

	Unit	Farmers		t-test	
		Smallholders	Medium-scale tenants	t-value	Prob()
Background					
Education level	years of schooling	5.1	7.5	6.74	0.00
Age	number	41.5	37.9	-3.19	0.00
Gender	% male	94.6	98.9	2.41	0.02
Compared to rest of the kebele, your household is:					
Among richest in kebele	%	10.3	39.8	9.82	0.00
Richer than most in kebele	%	15.9	22.7	2.11	0.04
About average	%	57.3	35.2	-5.26	0.00
A little poorer than most in kebele	%	11.2	0.6	-4.43	0.00
Among poorest in kebele	%	5.4	1.7	-2.06	0.04
Vegetables production					
Type of irrigation used					
Lake	% of irrigated area	34.7	35.8	0.26	0.79
River	% of irrigated area	24.0	16.4	-2.22	0.03
Ground water	% of irrigated area	37.0	46.4	2.33	0.02
Pond	% of irrigated area	4.2	1.4	-1.80	0.07
Total		100.0	100.0		
Area of vegetables cultivated					
Rainy season	hectares/farmer	0.6	0.9	1.82	0.07
Irrigation season	hectares/farmer	0.8	4.6	15.20	0.00
Area rented in during irrigation season	hectares/farmer	0.3	3.5	18.83	0.00
Type of vegetable grown					
a. Tomato	% vegetable area	10.0	39.1	11.74	0.00
b. Onion	% vegetable area	37.3	43.8	1.84	0.07
c. Cabbage	% vegetable area	7.5	5.8	-0.97	0.33
d. Green pepper	% vegetable area	12.8	5.4	-3.18	0.00
e. Ethiopian kale	% vegetable area	24.9	4.1	-6.91	0.00
f. Other	% vegetable area	7.5	1.7	-3.10	0.00

Source: Household survey.

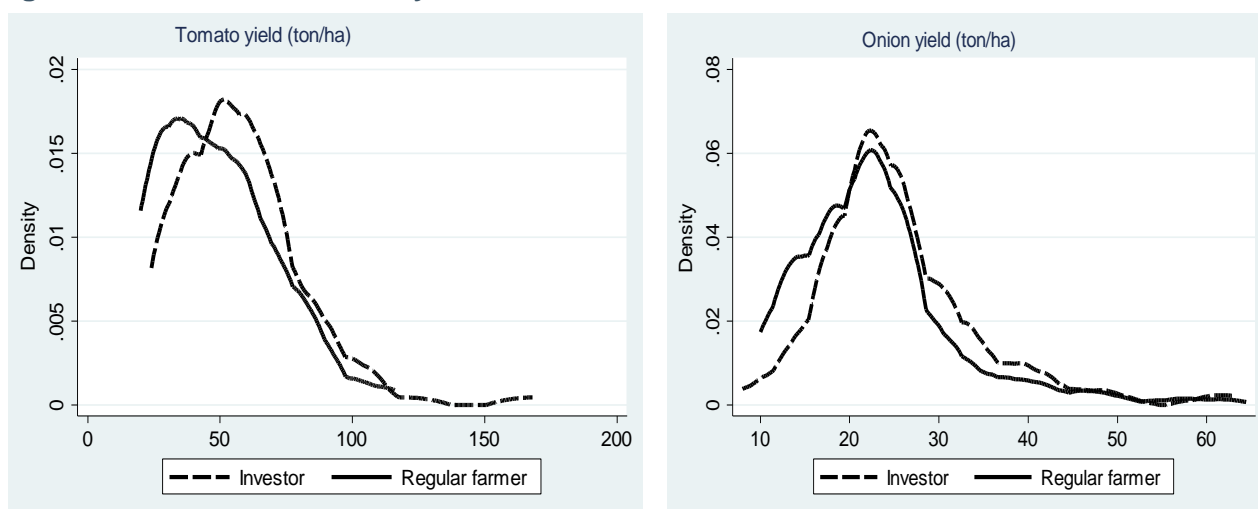
These medium-scale tenant farmers have typically more capital at their disposal than smallholders to invest in required equipment (digging of wells; investments in pumps, water hoses, or generators), to finance upfront costs of labor and agricultural inputs, and to absorb risks in vegetable cultivation and marketing. They might also have more know-how. Table 4.4 illustrates some of the differences between medium-scale tenant farmers and smallholders. The former are significantly more educated (7.5 years of schooling on average compared to 5 years for smallholders) and they are significantly better-off economically. While 10 percent of smallholders considers themselves to be among the richest in the kebele, that percentage is as high as 40 percent for the medium-scale tenant farmers. Medium-scale farmers also rely significantly more on more costly groundwater irrigation (46 percent of medium-scale farmers) than do smallholders.

⁴ Yields of 60 tons per hectare; 5 Birr per kg; 300,000 Birr output per hectare.

We further find that medium-scale tenant farmers are able to produce more vegetable output.

- First, they cultivate more vegetable land than smallholders – in the irrigation season they cultivate on average 4.6 hectares of vegetables, six times the vegetable area of smallholders. The large majority of the land of these medium-scale farmers (77 percent) is rented in.
- Second, they grow different vegetables than smallholders. They focus more on higher-value vegetables that require more investments in labor and inputs. 40 percent of the vegetable area cultivated by medium-scale farmers is allocated to tomato, while this is only 10 percent for smallholders. They also grow significantly more onions. Smallholders on the other hand focus relatively more on green pepper and Ethiopian kale.
- Third, they use land more intensively and are able to obtain significantly higher yields even if they grow the same crops (Figure 4.2). T-tests show that these differences are significant for three out of four crops.

Figure 4.2: Tomato and onion yields, medium-scale farmers versus smallholders



Source: Household survey.

While these tenant farmers farm small areas in international terms, they are large for Ethiopia – where average landholdings are around 1 ha (Dorosh and Minten 2020) – and also are large when we look at output values. We estimate the average value of their vegetable output in the year before the survey at about 52,000 USD, or 60 times the average GDP per capita in 2019.^{5, 6}

4.3. Modern input use

The increase in vegetable production is also linked to the intensive use of modern inputs. First, hybrid seeds are widely used in vegetable cultivation, in contrast with other crops in Ethiopia (Table 4.5). These seeds are all imported – as shown in the registration records of their improved seed varieties, a number of bigger multinational seed companies are involved. Table 4.5 shows that hybrid seeds are especially important in the case of tomato growers. We further see significant differences between smallholders and the medium-scale tenant farmers with the latter relying significantly more on such hybrid seeds. Most of the vegetable seeds are obtained from private agro-dealers, while government-supported cooperatives play a relatively minor role in the distribution of these seeds. It also noteworthy that medium-scale tenant farmers rely significantly more on the services of specialized seed distributors.

⁵ 857 USD in 2019 (World Bank, <https://data.worldbank.org/>)

⁶ Their success is in contrast to larger-scale “investors” that were offered cheap land or land for free, typically in the range of 30-50 hectares, and cheap loans. Nearly all failed (personal communication, Gerrit Holtland).

Table 4.5: Use of modern inputs in vegetable production

		Farmers		t-test	
		Smallholders	Medium-scale tenants	t-value	Prob()
Seed					
Share of area on which imported hybrid seed used:					
a. Tomato	%	62.1	82.5	3.46	0.00
b. Onion	%	8.6	25.7	4.78	0.00
c. Cabbage	%	51.0	71.3	0.84	0.41
d. Green pepper	%	17.2	70.0	3.17	0.00
Seeds mostly obtained from:					
a. Cooperatives	%	12.3	10.2	-0.75	0.45
b. Private agro-dealers	%	66.7	55.1	-2.85	0.00
c. Private seed distributors (e.g., Agro Greenlife)	%	5.7	31.3	10.07	0.00
d. Not bought, from own farm	%	2.4	0.6	-1.52	0.13
e. Others (NGO etc.)	%	12.9	2.8	-3.86	0.00
Total	%	100.0	100.0		
Chemical fertilizer use					
Fertilizer application rate					
a. Tomato	kg/ha	942	1,284	3.01	0.00
b. Onion	kg/ha	845	1,008	2.43	0.02
c. Cabbage	kg/ha	647	1,088	1.95	0.06
d. Green pepper	kg/ha	499	1,360	4.53	0.00
Fertilizer obtained from					
a. Cooperatives	%	59.8	65.3	1.34	0.18
b. Private agro-dealers	%	21.0	19.3	-0.48	0.63
e. Others (local traders, other farmers etc.)	%	19.2	15.3	-1.18	0.24
Total	%	100.0	100.0		
Agro-chemicals					
Number of sprayings					
a. Tomato	number	18.5	22.4	1.31	0.19
b. Onion	number	11.0	11.3	0.37	0.71
c. Cabbage	number	12.4	13.5	0.19	0.85
d. Green pepper	number	8.5	15.3	1.06	0.10
Agro-chemicals obtained from					
a. Cooperatives	%	11.2	12.5	0.48	0.63
b. Private agro-dealers	%	69.6	72.7	0.81	0.42
c. Other local traders	%	17.8	14.8	-0.95	0.34

Source: Household survey.

Second, we see a large use of chemicals in vegetable production. All producers use large amounts of fertilizers, averages ranging between 1.0 and 1.4 tons per hectare – depending on the crop – for medium-scale tenant farmers, i.e. significantly above the level used for cereals and the official recommendation of 0.3 tons/ha. Medium-scale farmers again use inputs more intensively than smallholders. The fertilizer is mostly obtained from cooperatives. However, about 30 percent of vegetable farmers obtain fertilizers through other channels. In doing so, they pay relatively higher prices for these fertilizer, as they typically are obtained from the informal market (only cooperatives distribute major fertilizers in Ethiopia (Rashid et al. 2013)).

We also note a high use of agro-chemicals. The number of sprayings is highest in the case of tomato with up to 22 per cultivation season for medium-scale tenant farmers compared to 18 for smallholders. It is lowest in the case of cabbage, but on average still 8 spraying were done. Overall, we see no significant differences in number of sprayings between smallholders and

medium-scale tenant farmers. However, the types of agro-chemicals might be different with medium-scale farmers often focusing on more expensive agro-chemicals.⁷ These agro-chemicals also are mostly obtained from private agro-dealers, who have catered to their increased demand, leading to significant business growth in this area.⁸

Previous assessments on agricultural transformation in Ethiopia have highlighted the important role that the government has played in driving that transformation through the provision of widespread extension advice and the distribution of modern inputs through government supported cooperatives (Bachewe et al. 2018, Rashid et al. 2013). In contrast, the transformation in the vegetable sector in the Central Rift Valley has been mostly private-sector led – we see the importance of widespread adoption of imported hybrid seeds and agri-chemicals distributed by private agro-dealers and chemical fertilizers that are regularly obtained through non-official channels at higher prices. As the vegetable sector has received little attention from the government, which has been mostly focused on cereal production and export crops, it seems that these changes have been happening mostly under the radar, largely driven by rapid demand changes, mostly from urban areas.

5. THE EMERGING RURAL GIG ECONOMY FOR VEGETABLE SERVICES

5.1. Labor contracts

Vegetable farmers rely heavily on hired laborers in the process of vegetable cultivation. Table 5.1 shows that the majority of work in vegetable cultivation is outsourced, with own family labor accounting for a small part of all the work done in vegetable cultivation. This pattern stands in sharp contrast to how family labor is employed for other crops (Bachewe et al. 2016). Own labor typically accounts for less than 40 percent of labor use for any agricultural task related to vegetable production for smallholders and less than 10 percent in the case of medium-scale farmers.

Table 5.1: Family labor as share of all labor used in vegetable cultivation, by activity

		Farmers		Proportion test	
		Smallholders	Medium-scale tenants	t-value	Prob()
Own labor as share of activity					
a. Guarding field	%	29.9	3.6	-7.30	0.00
b. Plowing	%	37.1	4.5	-8.71	0.00
c. Fencing	%	35.1	6.4	-6.77	0.00
d. Planting	%	14.8	0.0	-5.51	0.00
e. Sticking/building ladders	%	21.6	0.0	-5.76	0.00
f. Tying plants	%	16.1	0.9	-4.32	0.00
g. Spraying	%	41.5	5.1	-9.49	0.00
h. Fertilizer use	%	46.8	8.0	-9.90	0.00
i. Irrigation	%	41.0	6.8	-8.88	0.00
j. Harvesting	%	16.0	0.0	-5.77	0.00

Source: Household survey

The outsourced laborers are offered different arrangements in the form of daily, monthly, or piecemeal contracts. Piecemeal contracts – under which workers are paid for a job done instead of

⁷ A lack of diversity of active ingredients in pesticides means that farmers repeatedly use the same pesticides, which imply that crops become increasingly resistant, which forces the farmers to apply even more pesticides (Gerrit Holtland, personal communication).

⁸ For example, key informants indicated that at the time of the survey 35 shops were selling agro-chemicals in the main town of Meki, supplying a number of these villages that we interviewed. This compares to only 10 such shops ten years before the survey.

for a day of work – are especially important for plowing and fencing and are significantly more used by medium-scale tenant farmers than by smallholders.

Table 5.2: Labor contract conditions in vegetable cultivation

		Farmers		Proportion or t-test	
		Smallholders	Medium-scale tenants	t-value	Prob()
Daily contract					
Contracts used by farmer	% yes	72.6	79.0	-1.51	0.13
If yes,					
Typical salaries paid last year	Birr/day	120	140	-6.82	0.00
Share women that have these contracts	%	35.4	30.0	2.09	0.04
Who pays for housing?	% worker	95.9	95.7	0.10	0.92
... for food/drinks?	% worker	51.1	46.8	0.62	0.54
... for health care when sick?	% worker	97.6	96.4	0.76	0.45
... for phone costs?	% worker	90.4	85.0	0.50	0.62
... for clothes at work?	% worker	98.8	94.1	2.53	0.01
Workers wear protective equipment?	% worker	20.0	18.7	0.15	0.88
How many hours worked per day?	hours	7.9	8.1	-2.25	0.02
Seasonal contract					
Contracts used by farmer	% yes	56.9	85.8	-6.26	0.00
If yes,					
Typical salaries paid last year	Birr/month	1,365	1,603	-4.68	0.00
Share women that have these contracts	%	3.6	3.5	0.09	0.93
Who pays for housing?	% worker	34.9	22.5	1.37	0.17
... for food/drinks?	% worker	28.0	17.9	1.06	0.29
... for health care when sick?	% worker	70.6	55.6	2.54	0.01
... for phone costs?	% worker	89.2	76.2	3.44	0.00
... for clothes at work?	% worker	87.4	81.0	1.42	0.16
Workers wear protective equipment?	% worker	22.7	18.5	0.46	0.64
How many days worked per month?	days	27.3	28.0	-1.59	0.11
How many hours worked per day?	hours	10.2	10.0	0.42	0.68
Permanent contract					
Contracts used by farmer	% yes	4.1	14.2	-1.26	0.21
If yes,					
Typical salaries paid last year	Birr/month	1,398	1,728	-1.73	0.09
Share women that have these contracts	%	8.0	3.3	0.95	0.35
Who pays for housing?	% worker	26.9	24.0	0.12	0.90
... for food/drinks?	% worker	26.9	20.0	0.28	0.78
... for health care when sick?	% worker	53.9	60.0	-0.33	0.74
... for phone costs?	% worker	92.3	64.0	2.24	0.03
... for clothes at work?	% worker	85.0	83.3	0.13	0.90
Workers wear protective equipment?	% worker	26.9	28.0	-0.05	0.96
How many days worked per month?	days	27.3	27.0	0.28	0.78
How many hours worked per day?	hours	9.8	7.6	2.85	0.01

Source: Household survey

Contracts of different duration are used – permanent, seasonal, and daily (Table 5.2). For the longer-term contracts, wages offered vary between 44 and 54 USD⁹ per month for smallholders or medium-scale farmers, respectively, and depend to some degree on whether the contract duration is seasonal or permanent. Daily wages are on average 3.7 and 4.4 USD per day for daily laborers for smallholders and medium-scale farmers, respectively. Wages paid by medium-scale tenant farmers are on average significantly higher than those paid by smallholders. Table 5.2 further

⁹ At an exchange rate of 32 Birr/USD in February 2020.

shows that daily workers work on average about 8 hours per day, while those with seasonal contracts work for more than 8 hours per day. Women are rarely employed under longer-term contracts, but they make up about one-third of daily laborers.

To further understand the nature of the labor contracts used, we asked about the different benefits that workers obtain with these labor arrangements. There are only a limited number of benefits, especially if workers have daily contracts (Table 5.2). For example, only 3 to 4 percent of daily workers receive help from the employer for health care. This increases to close to 50 percent for seasonal and permanent workers. Housing is often provided by the employer in the case of longer-term contracts. Food and drink is often provided by employers – about three-quarters of the seasonal and permanent workers and half of the daily workers receive food and drink from their employer. However, phone and costs for clothes or are typically not included in the contract, and a minority of farmers report that their workers wear protective equipment (such as gloves and masks) despite possible health impacts due to the high use of agro-chemicals on these vegetables.

The labor contracts overall are simple with few extra benefits provided on top of the basic salary, even for longer-term contracts. Wages are, by international standards, low but they are on average higher than those paid in the newly established industrial parks located close to this area (Jordon 2019, Blattman and Dercon 2018). Hired workers in vegetable production typically do not come from the local village, but the majority migrate from the poorer south of the country (the Southern Nations, Nationalities, and Peoples' (SNNP) Region). The majority of workers were reported to be hired from daily labor markets that are organized in the center of the woredas.¹⁰

We further estimate direct job creation for agricultural laborers in this horticultural cluster¹¹ at 4,350, about 20 percent of the level of workers employed in the successful Hawassa industrial park nearby. However, the numbers of people employed is higher during the irrigation season as less laborers are required during the Meher season, when mostly less labor-intensive cereal crops are grown. This estimate does not take into consideration the additional job demand in the service economies supporting vegetable cultivation.

5.2. Service economy

For the different services required in vegetable cultivation, contractors are widely used. Table 5.3 shows the extent of the use of such services. For example, 89 and 49 percent of the medium-scale tenant farmers and smallholders, respectively, indicated that they use machines to plow their vegetable plots, a significantly higher rate than is used in other crop sectors in Ethiopia (Berhane et al. 2020), with most using mechanization service providers. Other contractors are relatively less important, but they still are a sizable number – for digging wells, 32 and 36 percent of medium-scale farmers and smallholders, respectively, use contractors, while for ponds, 57 and 43 percent of medium-scale farmers and smallholders, respectively, do so. In the case that no contractors were used, laborers hired-in by the cultivator play a significant role in these activities – indicating again the importance of these labor markets for the vegetable sector. For all such activities in vegetable production, smallholders do these tasks significantly more themselves and rely significantly less on hired-in labor or contractors.

We further see the use of larger companies and enterprises that do the propagation of seedlings for the farmers. They are significantly more used by medium-scale farmers compared to smallholders. In the case of tomato, 55 percent of the area cultivated by medium-scale farmers was planted with seedlings produced by a contractor, while for smallholders, only 25 percent was.

¹⁰ While brokers were reportedly used by some farmers, they are relatively less important.

¹¹ By looking at the hired workers on these farms and using a conservative estimate of number of days worked per year by them (190 days/year).

We further see significant differences by crop. Commercial seedling propagation is relatively more common for tomato and green pepper.

Table 5.3: Services in vegetable cultivation

		Farmers		t-test	
		Smallholders	Medium-scale tenants	t-value	Prob()
Diggings wells					
a. Done by cultivators themselves	%	21.3	7.3	0.81	0.42
b. Done by daily laborers hired by cultivator	%	42.2	61.0	-2.16	0.03
c. Done by contractor	%	36.5	31.7	0.45	0.65
Contractor contacted by mobile phone	%	48.8	69.2	-1.45	0.15
Digging ponds					
Share of farmers where ponds are used	%	20.5	10.3		
a. Ponds dug by cultivators themselves	%	50.0	14.3	0.67	0.50
b. Ponds dug by daily laborers hired by cultivator	%	7.1	28.6		
c. Ponds dug by contractor	%	42.9	57.1	-0.44	0.66
Contractor contacted by mobile phone	%	33.3	75.0	-1.03	0.30
Mechanization - plowing					
Share of farmers using tractors for plowing	%	49.2	88.7	-10.43	0.00
Of those that use tractors, service providers rented in	%	90.4	87.9	0.87	0.38
Contractor contacted by mobile phone	%	68.9	90.3	-4.58	0.00
Seedlings grown by large enterprise-contractors					
a. Tomato	% area	25.1	54.8	-3.93	0.00
b. Onion	% area	2.8	16.2	-4.51	0.00
c. Cabbage	% area	10.4	0.0	0.68	0.50
d. Green pepper	% area	10.5	54.0	-2.83	0.00
Output markets					
Share of vegetable sold on farm	%	62.6	94.9	-7.81	0.00
To sell vegetables, farmer relies on					
a. finding buyer him/herself	%	43.2	17.6	2.75	0.01
b. a local broker	%	46.9	61.9	-2.69	0.01
c. a broker from cities	%	8.7	20.5	-1.61	0.11
Buyer takes care of contracting of harvesting	% yes	7.4	6.8	0.07	0.94
Buyer takes care of contract for loading of truck	% yes	43.4	66.5	-4.19	0.00
Trader/broker contacted by mobile phone	%	64.2	85.8	-4.95	0.00

Source: Household survey

In output markets, produce is mostly sold at the farmgate, but medium-scale farmers do this more than smallholders – 95 and 63 percent of the produce is sold at the farmgate by medium-scale farmers and smallholders, respectively. As farmers seldom travel to markets to sell vegetables, buyers have to be found differently. Brokers paid on commission often facilitate the finding of buyers (Table 5.3). The services of a broker are again much more used by medium-scale farmers (82 percent of sales) than by smallholders (57 percent of sales). Moreover, if a broker is used, the type of broker that medium-scale farmers rely upon is different, as medium-scale farmers more often contact brokers located in big cities, while smallholders rely on local ones. Buyers pick up produce at the farm and provide a number of other services, often sub-contracted. While contracting for harvesting is relatively less used (7 percent), loading of the truck is usually contracted out to buyers, but significantly more so by medium-scale farmers than by smallholders.¹² We further asked how contractors were contacted. While the spread of mobile phones in Ethiopia has been slower than in other countries (Nakasone et al. 2014), they are

¹² Recently, a number of youth groups have become involved in such work and have started monopolizing these activities in some areas at high rates.

increasingly being used in these commercial vegetable areas. We see that mobile phones are widely used to contact well diggers, mechanization service providers, and output buyers. While half or more than half of smallholders (48, 69, and 64 percent, respectively) indicated using mobile phones to obtain these services, this was however much higher for medium-scale farmers at 69, 90, and 86 percent, respectively.

We therefore find that private agricultural service providers and contractors for short-term tasks are actively used for a large number of activities in vegetable production. These service providers are often contacted through mobile phones and search transaction costs have been significantly reduced because of these easier communication means. While the spread of mobile phones to rural areas might not have been the cause of the emergence of this gig and service economy, it seems that it might have significantly contributed to its emergence.

6. THE COVID-19 DISRUPTION

While the vegetable sector has shown important changes over the last decade, the COVID-19 crisis has created obvious issues for the sector. First, there was a reduction in the demand of vegetables, partly driven by income effects but also by a perception of raw vegetables being linked to infection by the virus (Hirvonen et al. 2020; Tamru et al. 2020). Moreover, transporters were increasingly worried about going to rural areas given uncertainty surrounding travel as well as the possible risks of getting infected (Tamru et al. 2020). As the government blocked land transport from neighboring countries, this also affected international trade, leading to the disruption of modern input supply chains – especially of seeds and agro-chemicals – that vegetable producers significantly rely upon.

Table 6.1 shows the extent to which vegetable farmers adjusted their behavior since the start of the pandemic. It is clear that farmers are aware of problems that infection by the virus might cause and they have adapted their behavior accordingly. The majority of farmers indicated that they have avoided hiring workers and going to labor markets to hire workers. They have also avoided going to agro-dealers out of fear of getting infected and have reduced their contacts with extension agents, other farmers, and traders. We further note that the provision of services has been disrupted and only a small share of farmers indicate that they can easily find mechanization service providers, quality seed, and companies to propagate their seedlings. However, medium-scale farmers, who typically use these services relatively more, complain less about these disruptions and constraints than do smallholders.

Table 6.1: Adjustments in behavior by vegetable farmers since start of COVID-19 pandemic

		Farmers		Proportion test	
		Smallholders	Medium-scale tenants	z-value	Prob()
Avoided going to the market to find laborers	% yes	58.4	49.3	1.27	0.20
Avoided hiring laborers	% yes	63.8	47.8	2.26	0.02
Required workers to wear masks and/or disposable gloves	% yes	45.3	59.7	-2.04	0.04
Avoided going to agro-dealers	% yes	35.2	35.8	-0.07	0.94
Avoided contact with other farmers	% yes	49.7	67.9	-2.76	0.01
Avoided contact with DAs or other extension agents	% yes	76.5	85.8	-2.02	0.04
Avoided being in contact with output traders	% yes	42.3	53.0	-1.45	0.15
Share of farmers that...					
... believe mechanization providers are easy to find	%	33.1	48.5	-1.98	0.05
... believe that quality seeds are easy to obtain	%	22.4	36.6	-1.67	0.10
... believe outsourcing of seedling growing to contractors is easy	%	19.1	35.1	-1.93	0.05

Source: Household survey, phone follow-up survey

To assess the impacts of COVID-19 disruptions on their vegetable production activities, we asked qualitative questions on the effects on access to inputs and services, access to labor markets, output market functioning, and plans for the future. On the input side, we see a significant worsening in their functioning, although not all of this change may be linked to the COVID-19 crisis, given the foreign exchange problems in the country (World Bank 2019). Table 6.2 shows that the majority of farmers indicate that they use less fertilizer, spray less, and use less labor than normally. Given that medium-scale farmers rely more on these labor markets than smallholders, they are more impacted by their disruption – 68 percent of the medium-scale farmers indicated that they used less labor now than normally for vegetable production, a significantly higher number than for smallholders (52 percent).

Table 6.2: COVID-19 effects on vegetable cultivation

		Farmers		Proportion test	
		Smallholders	Medium-scale tenants	z-value	Prob()
Production and inputs					
Share of farmers that...					
... that spray less than normally	%	42.8	38.8	0.49	0.62
... that use less fertilizer than normally	%	48.2	45.5	0.35	0.73
... that use less labor than normally	%	51.8	67.9	-2.46	0.01
... that expect or have yields that are lower than normal	%	51.2	50.0	0.16	0.87
Major reasons for lower yields:					
a. Lack of good seed	%	1.3	4.5	-0.20	0.84
b. Lack of fertilizer	%	41.8	22.4	1.40	0.16
c. Lack of agro-chemicals	%	34.0	28.4	0.45	0.65
d. Lack of labor	%	10.5	17.9	-0.57	0.57
e. Other	%	12.4	26.9	-1.11	0.27
Share of farmers able to sell all vegetables	%	82.9	57.8	3.46	0.00
Income changes					
Replies of farmers to "In the past 30 days would you say that your household received more or less income compared to the income you usually receive at this time of the year?"					
Much less	%	8.7	10.5	-0.18	0.856
Less	%	50.8	53.0	-0.30	0.765
Same	%	28.1	26.1	0.22	0.826
More	%	11.0	9.7	0.13	0.895
Much more	%	1.3	0.8	0.05	0.962
Future plans					
Share of farmers that...					
... intend to grow vegetables in next rainy season	%	77.5	88.8	-2.57	0.01
... intend to grow vegetables in next irrigation season	%	94.6	88.1	2.30	0.02
Intention of farmers on land rental in next irrigation season:					
No change	%	42.6	20.9	2.14	0.03
Rent in more	%	43.0	59.0	-2.24	0.03
Rent in less	%	2.4	3.0	-0.06	0.95
Rent out more	%	1.0	1.5	-0.05	0.96
Rent out less	%	0.3	0.0		
Do not know yet	%	10.7	15.7	-0.53	0.60

Source: Household survey, phone follow-up survey

About half of the vegetable farmers further indicated that they expect their yields will be lower than normal. Medium-scale farmers and smallholders were impacted in a similar manner, as we see no significant difference between them in their expectations on yields. The major reason reported for the expected lower yields was lack of access to inputs (agro-chemicals and fertilizers). While medium-scale farmers mentioned the lack of labor relatively more as a major reason than

smallholders, that difference, however, is not significant. On the marketing side, we see that medium-scale farmers have been more impacted by an inability to sell their vegetables in the month before the survey. While 43 percent of medium-scale farmers mentioned problems in selling all their vegetables, only 17 percent of smallholders reported such problems.

We further asked farmers about ongoing prices for some inputs, such as plowing, labor, and fertilizers, as well as about output prices. We then compare those to the situation three months earlier at the time of the first round of the survey. To test for differences over this period, we perform a t-test for all observations in first and second rounds and then ran a fixed-effect model to analyze the effects specifically for those households that were interviewed in both rounds, controlling for household characteristics. In the fixed effect model, we further interact with a medium-scale tenant farmer dummy to test if medium-scale farmers have been affected in a different way than smallholders.

Table 6.3 shows the results for factor prices. We note that all factor prices have significantly increased over the three-month period as shown by the t-tests as well as by the fixed effect model results. While inflation is relatively high in Ethiopia – it stood at 19.8 percent per year in May 2020 (CSA 2020) – factor costs have been changing more rapidly, especially so for wages. As indicated in the fixed-effects model, plowing costs increased significantly by 12 percent between the two periods. The prices of the three main fertilizers used (DAP, Urea, and NPS) also increased significantly by 9, 11, and 6 percent, respectively. However, the biggest increases were noted for agricultural wages which increased by 36 (in t-test) and 30 percent (for fixed effect model) over the period considered. Given that the latter is a major cost for the production of vegetables, this suggest that production cost increases for vegetable production have been substantial since the start of the COVID-19 pandemic.

Table 6.3: Factor prices in vegetable cultivation under the COVID-19 pandemic

t-test		Plowing Birr/ha	Wages Birr/day	DAP fertilizer Birr/kg	Urea fertilizer Birr/kg	NPS fertilizer Birr/kg
Jan-Feb survey (1st round)	mean	522.2	126.9	1502.9	1412.4	1518.9
	std. dev.	47.7	23.7	109.2	126.8	89.6
	median	500	120	1500	1400	1500
	observations	452	555	336	720	518
May-June survey (2nd round)	mean	578.2	173.6	1623.7	1564.2	1627.6
	std. dev.	80.5	44.8	140.5	155.3	134.8
	median	600	160	1600	1600	1700
	observations	431	432	352	414	102
t-test	t-value	-12.65	-21.06	-12.55	-17.85	-10.19
	prob()	0.00	0.00	0.00	0.00	0.00
Fixed effect model (at farm level)						
		ln(Birr/ha)	ln(Birr/day)	ln(Birr/kg)	ln(Birr/kg)	ln(Birr/kg)
2nd round	coefficient	0.120	0.305	0.094	0.115	0.058
	t-value	11.64	17.80	8.93	10.89	3.69
2nd round * medium- scale tenants	coefficient	-0.005	0.010	0.008	-0.008	-0.020
	t-value	-0.27	0.36	0.45	-0.51	-0.71
observations		883	987	688	1134	620
groups		611	674	473	673	423
R ² overall		0.15	0.31	0.18	0.21	0.13

Source: Household survey, phone follow-up survey

Note: Standard errors clustered at the household level

To understand to what extent farmers' incomes and profits have been affected since the start of the pandemic, we look in a similar fashion at output prices (Table 6.4). We see large changes in prices for all vegetables, but different patterns by vegetable. Onion and tomato show large

increases at 54 and 33 percent, respectively. On the other hand, pepper and cabbage have shown large decreases by 66 and 41 percent, respectively. The significant increase in the price of onions might have been linked to the closure of some regional borders as well as land borders with Sudan due to the COVID-19 pandemic. In a typical year, Ethiopia imports a significant tonnage of onions from Sudan – e.g., 16.1 million USD in 2018.¹³ However, as borders have been closed, the shortage of onions from Sudan seemingly has led to a significant price increase, as was indicated in a number of our key informant interviews.

Table 6.4: Output prices in vegetable cultivation under the COVID-19 pandemic

t-test		Tomato Birr/kg	Onion Birr/kg	Green pepper Birr/kg	Cabbage Birr/kg
Jan-Feb survey	mean	5.84	13.46	21.8	7.24
(1st round)	std. dev.	2.35	3.04	9.91	3.49
	median	5	14	20	6.75
	observations	933	1,052	671	670
May-June survey	mean	10.47	18.88	12.02	4.46
(2nd round)	std. dev.	2.75	4.67	6.98	2.71
	median	10	19	10	3.5
	observations	610	602	337	348
t-test	t-value	-35.25	-28.56	16.21	12.96
	prob()	0.00	0.00	0.00	0.00
Fixed effect model (at farm level)					
		ln(Birr/kg)	ln(Birr/kg)	ln(Birr/kg)	ln(Birr/kg)
2nd round	coefficient	0.54	0.33	-0.66	-0.41
	t-value	12.98	13.88	-9.83	-7.60
2nd round * medium-scale tenants	coefficient	0.20	-0.06	-0.18	0.10
	t-value	3.58	-1.41	-1.49	1.21
Quality indicators included? †	yes	yes	yes	yes	yes
	observations	1,543	1,654	1,008	1,018
	groups	697	713	546	539
	R ² overall	0.45	0.40	0.37	0.24

Source: Household survey, phone follow-up survey

Note: Standard errors clustered at the household level

† Quality indicators by vegetable:

Tomato: seed type, form, length, ripeness, and overall quality assessment.

Onion: seed type, length, moisture, and overall quality assessment.

Green pepper: seed type, length, thickness, color, and overall quality assessment.

Cabbage: seed type, size, density, and overall quality assessment.

In all cases, medium-scale farmers are impacted to the same extent by these changes as smallholders, as seen by the non-significant interaction coefficients of medium-scale farmers with the second-period dummy in the fixed-effect models.¹⁴ However, as noted earlier, medium-scale farmers more intensively use inputs and services and their production costs might therefore have gone up more substantially (or they might have reduced their input use accordingly). On the other hand, those vegetables that are grown relatively more by medium-scale farmers (onions and tomatoes) have seen price improvements, in contrast to those grown relatively more by smallholders. Finally, it is worth noting that prices of inputs have increased to a lesser extent than prices of output increased for tomatoes. Input/output price ratios have seemingly stabilized for onions, while they have deteriorated for those farmers involved in cabbage and green pepper cultivation.

These heterogeneous impacts are confirmed by qualitative statements on income changes by vegetable farmers. Overall, 60 percent of these farmers state that their incomes have deteriorated

¹³ Data downloaded from <https://comtrade.un.org/data/>.

¹⁴ The only exception is tomato, where medium-scale farmers saw a 10 percent higher increase.

compared to the same period last year. However, a number of them state that the situation improved (12 percent), while 28 percent indicated that there were no major changes. Finally, we asked vegetable farmers about their plans for the future (Table 6.2). While 5 percent of the smallholders indicated that they were not sure that they would grow vegetables in the next irrigation season, that number is significantly higher for the medium-scale farmers at 12 percent. Interestingly, for those medium-scale tenant farmers that were planning to continue investing in vegetables, they were planning to rent in more land, possibly a reflection that some of them might have benefited from the COVID-19 pandemic situation.

7. CONCLUSIONS

Important changes have happened in the commercial vegetable sector in Ethiopia. The growing demand from urban areas has led to a rapid expansion of vegetable production in a commercial cluster in the Central Rift Valley in Ethiopia. This increasing production has been private-sector-led and has been driven by a rapid increase in irrigation, investments by richer medium-scale tenant farmers, and the wide use of modern inputs. Moreover, migrant labor and an important service sector have developed that have fueled that change. While production has soared, a number of challenges remain, including lack of support for horticultural extension by the government, which has been mostly focused on cereal production and less on this high-value products; the over-use of harmful pesticides, possibly leading to environmental problems; and increasing water access and resource overuse (Getnet et al. 2014). We further show that these changes have been significantly disrupted by the COVID-19 crisis. A large share of the vegetable farmers complained about more difficult access to modern inputs, higher prices for these inputs, lack of access to laborers, and reduced yields since the crisis began.

While there has been concern globally of the COVID-19 pandemic leading to general food crises, attention has in the short-run mostly focused on trade, logistics, and output markets given that enough produce was available worldwide at the start of the pandemic (Torero 2020). However, this might start to change in some cases. We find here in the case of vegetables in Ethiopia that production has already been affected by the COVID-19 crisis, due to the short vegetable production cycles throughout the year. This situation requires close monitoring. Given disruptions in logistics and mostly a deterioration in input and output markets, farmers will have lower incentives to produce vegetables, possibly leading to even lower production in the near future. To avoid further disruptions to the food supply system, ensuring the availability of agricultural inputs to farmers at affordable prices and assuring incentives for production should be a priority for the government in the next few months. This is especially important for the vegetable sector if we are to see a continuation in the transformative evolutions realized over the last decade and to contribute to improved nutritional outcomes in the country in the future.

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