The Effects of Commercial Orientation on (Agro) Pastoralists’ Household Food Security: Evidence from (Agro) Pastoral Communities of Afar, Northeastern Ethiopia

Derib Woldeyohannes Benti 1,*, Worku Tuffa Biru 2 and Workneh Kassa Tessema 3

1 Department of Rural Development, College of Agriculture, Wolaita Sodo University, Wolaita Sodo 138, Ethiopia
2 Center for Rural Development, College of Development Studies, Addis Ababa University, Addis Ababa 1178, Ethiopia; worksha2010@gmail.com
3 Department of Management, College of Business and Economics, Addis Ababa University, Addis Ababa 1176, Ethiopia; worknehtessema@gmail.com
* Correspondence: derib.woldeyohannes@aau.edu.et

Abstract: Commercialization has been increasingly promoted for (agro) pastoral communities as an intervention to improve incomes and food access. Using households from rural Afar, this study examines the food security effects of the livestock commercial orientations of (agro) pastoralists by employing propensity score matching (PSM) procedures. The results show that, despite the fact that the market production of (agro) pastoralists is stressed by a broad range of factors, identified as cultural, infrastructural, and production risks, participation in livestock sales significantly decreased the severity of food insecurity in both the household food insecurity access score (HFIAS), and the reduced coping strategy index (rCSI) measures. However, the results failed to find consistently significant effects via the per capita consumption expenditure measure, in which case, the ‘subsistence’ and ‘commercially’ oriented groups are alike. Yet, given the factors depressing market production, properly addressed with policy measures, the income generated from livestock sales improved the welfare of (agro) pastoralists, at least by some (the HFIAS and rCSI) of the livelihood indicators. This highlights the importance of combining market infrastructure investments with culturally sensitive policy measures in order to sustain the traditional livestock husbandry of (agro) pastoralists. Therefore, in order to sustainably improve the food security situations in (agro) pastoral areas, the promotion of market production through the broadening of market access for both sales and purchases is important.

Keywords: (agro) pastoralists; livestock marketing; commercialization; food security; Afar; Ethiopia

1. Introduction

Pastoralism, as a mode of production, contributes significantly to household energy requirements, directly, through the consumption of pastoral produce (animal food sources), and indirectly, through the marketing of pastoral products, which dominates over the marketing of nonpastoral foods [1]. In the latter case, economic/market interactions between pastoralists and neighboring farming communities becomes inevitable [2], whereby pastoralists sell livestock in times of financial need in order to purchase food and other necessities to complement their food consumption [3]. This means that the improvement in pastoralist livelihoods is dependent on a system of markets whereby they can bring their livestock and livestock products to sell, and, in return, buy nonpastoral foods, such as cereals, tea, and sugar [4,5]. As a result, pastoralists develop market exchange interdependence and economic interactions with cultivators and highland systems [6], requiring that the pastoral economy be economically indistinguishable from settled agriculturalists [7]. This, in turn, compels pastoralists to develop a ‘commercial mentality’ when pursuing their consumption needs.
Food security, in the pastoral setting, involves the availability of livestock and livestock products for consumption, and the capacities of pastoralists to buy grains for food [8,9]. Pastoralists rely heavily on livestock sales to finance their food purchases, so their market participation has an impact on their food security [4,5]. This means that the exchange value of livestock is as important as the consumptive value for pastoralists. Thus, livestock marketing and the ‘commercial mentality’ of pastoralists towards livestock are critical for understanding food security among pastoralists. This is because livestock is the main source of income with which pastoralists subsidize grain consumption, and food grain purchases make up the largest expenditure item for herders [10]. Moreover, livestock sales become an induced inescapable function in pastoral and agropastoral production, and increase in response to drought, pasture scarcity, and weather shocks [11,12].

Nevertheless, food insecurity, which is commonly perceived of as a condition in which people have limited access to safe, adequate, and nutritious food to meet their dietary needs for a productive, healthy, and active life [13], remains a growing concern among pastoralist communities around the world [14,15]. The problem of hunger and food insecurity among pastoralists shows an increase in terms of the number of people affected and the vast area coverage [16]. Pastoral regions, and most pastoralist groups, are drought-prone [7], which has adversely affected their livelihoods [6,17]. The recurrent droughts usually result in the loss of herds [17,18] and severe food shortages [17]. The regions are largely known for high and increased levels of poverty and destitution [19], chronic food insecurity [14,15], and relief dependence [3]. They are politically, economically, and socially marginalized [20,21], and are estranged from the central government [22].

The vulnerability context and low welfare levels in the arid and semiarid lowlands [23] necessitate a compelling justification for alternative livelihoods and for ways out [17], which beg governments for policy measures. One of the policy efforts is the integration of (agro) pastoralists into the market in order to support their livelihoods. The existing literature in this regard has documented attempts made and other related issues as points of departure. First, it has been boldly stressed in the literature on pastoralism that, in attempting to address the stresses in these areas, and, thus, secure livelihoods, the respective governments and donor agencies have responded strategically with policy terms. Consequently, pre-1990’s pastoral development policies focused on how to sedentize pastoralists, favoring sedentary lifestyles [20,24]. As a result, governments were encouraged to plan and implement sedentarization as a means of reorienting the centuries-old pastoralism towards the market [23], and addressing the fundamental issues that plague pastoral and agropastoral areas [25,26], thus promoting the ‘commercial mentality’ among pastoralists (commercialization of the sector) and bringing about economic diversification [12,14]. Such policy orientation has given rise to development prescriptions that advocate ‘moving pastoralists out of pastoralism’ [27]. Following the policy orientation, studies have also been conducted on the processes and impacts of the sedentarization policy on livelihoods [24,28]. Nevertheless, the evaluation studies indicate that the effects of the market interactions required by sedentism that are thought to improve wellbeing have attained limited success. Evidently, sedentary farming is blamed for impacting pastoralism itself [12], and has failed to bring about desirable results [24]. It does not provide equal marketing opportunities, nor does it appear to be correlated with commoditization [29], less adaptation compared to mobile pastoralism [30]; and worsening food security [20,28]. Furthermore, the settlement schemes depleted traditional risk management strategies and the socioeconomic exchange networks [31], aggravated rangeland degradation [32], and weakened traditional conflict handling [33], thereby exacerbating food insecurity. The market economy stands as a way out, and it remains one of the adaptation strategies [6,34], where it does not always hold [29], and the program impacts parallel the market effects. In previous studies, because the market is associated with sedentism, failure in the sedentarization scheme has been associated with the market’s adverse effects [12,30]. This suggests that little is known about the likely links between the commercial orientation of (agro) pastoralists and their food security positions, as previous studies are limited to policy evaluations.
Second, the existing literature is widely focused on the consumption of pastoral produce for food (direct) and the relations to food security \cite{12,35}; hence, it seems to be limited to addressing food self-sufficiency and the availability component of food security. The ‘marketing—food security’ link has barely been addressed in food security analyses concerning (agro) pastoralists, and studies emphasize food availability more than food accessibility. In Asenso-Okyere et al. \cite{35} and Kahsay et al. \cite{36}, for instance, livestock marketing indicators are not included as determinants of food security. Yet, in both cases, the linking of pastoralists to markets to increase incomes through commercialization (the sale of livestock and livestock products) is promoted among the efforts to enhance food security. Other attempts have also been made in relation to specific issues, such as cross-border trade and regional integration \cite{9} and livestock commercialization \cite{37}, in order to account for the effects of marketing on food security. Studies \cite{9,10,37} have approached pastoral marketing and food security relations from a caloric terms-of-trade (between grain and livestock and livestock products) perspective, as well as by looking at commodity price changes over time. This, however, does not properly measure food security, as it is only a proxy indicator. Other studies where issues of livestock marketing practices are barely considered include Megerasa et al. \cite{17}, whose study indicates that households practicing livestock diversification had significantly higher average take-offs in the form of livestock sales, with the higher take-offs leading to improvements in their access to food. In sum, not all these studies adequately investigate livestock marketing issues and food security relations in (agro) pastoralist contexts. This issue is particularly important among pastoral groups, who inhabit the marginal areas and whose food security is highly exchange-dependent.

Third, prior studies conducted on the effects of the market have focused more on settled upland agrarian societies rather than on pastoralists \cite{38,39}. Empirical evidence on the food security effects of the market in the context of (agro) pastoralists is lacking. Yet, considerable differences essentially appear among the pastoral and sedentary agriculturalist settings \cite{6}. In terms of access to markets, for example, pastoralists inhabit inhospitable marginal lands that are far distances from roads and market outlets; thus, accessing markets for them is usually difficult \cite{40}. Adding to this, the market’s functionality in these areas is hindered by high transaction costs and poor market infrastructures \cite{41,42}. This suggests that evidence as to how markets contribute to securing the food needs of (agro) pastoralists, in particular, is needed.

Previous marketing studies are: (a) Masked by sedentarism and policy evaluations; (b) Limited to addressing food self-sufficiency, with an emphasis on food availability more than food accessibility (focused on the direct consumption of pastoral produce for food); and (c) Focused more on settled agriculturalist societies. Given this, there is little empirical evidence on to what extent markets contribute to combating low welfare levels in (agro) pastoralist contexts. As a result, the roles that markets play in achieving the food security of (agro) pastoralists may have been overlooked. Therefore, this study aims to take account of the effects of marketing on food security, and to fill in the gaps in this regard. Thus, the objective of the current study was to analyze the effects of livestock marketing practices (livestock marketing practices are regarded, in this study, as the livestock ‘commercial-orientation’, measured as the proportion of total TLU sold to the total owned \cite{43}), where it measures the extent to which production is oriented towards the market \cite{44}, on household food security, on the basis of cross-sectional data from the (semi) arid regions of Ethiopia, where sedentarization continues to be promoted by the government \cite{45}. The study tests whether improved access to, and participation in, livestock marketing practices improved household disposable income, and, hence, exerted a positive effect on the food security positions of households.

2. Commercialization and Food Security in (Agro) Pastoral Settings

Food security in rural communities is a state in which rural people have secured access to food, for a healthy life at all times \cite{13}. Food security is often measured by
the absence of hunger, or by the low prevalence of food insecurity [46]. Recently, there has been growing interest in food security analyses, as food crises and the number of vulnerable populations (e.g., pastoralists) at the global level are escalating [47]. There is a high degree of vulnerability to food insecurity among (agro) pastoral communities all over the world [48,49]. In Ethiopia’s pastoralist communities, food insecurity is widespread, and it has remained a major development concern of the government [50]. Because of this, high levels of malnutrition are often a feature among the pastoral communities of these regions [23]. Studies have documented that a significant proportion of (agro) pastoralists are vulnerable to climate-induced shocks and stresses, often resulting in production failures that lead to the depletion of pastoral resources, ultimately causing food shortages [50,51].

The overall development of (semi) arid regions requires that (agro) pastoralists are well integrated into the market [4,5]. First, as an adaptation strategy against the undue circumstances mystifying (agro) pastoral production, the commercialization of the subsistence production system is indispensable. Commercialization—the transition of production practices from those that are highly subsistent towards those that are highly market-oriented—is becoming an inevitable phenomenon, as it is externally induced by the changes in production strategies [52], the increases in rural populations and incomes, and urbanization [53]. It is also evident that (agro) pastoral communities are going through serious self-generated and externally driven irreversible evolving processes, which necessitate the commercialization of the sector. The commercialization process, which necessitates the development of market infrastructure in (agro) pastoral areas, is benefiting herders by offering direct income from market participation. The direct income from commercialization further triggers indirect benefits through forward and backward linkages, investment in other income-generating activities, and the buying of consumer goods for food and other purposes, altogether contributing to improvements in food security [52,54]. Thus, commercialization serves as a possible driver of economic transition in rural areas, and as a stimulator of the rural economic growth process [44]. Second, at the global level, the demand for animal food sources is growing rapidly, which calls for the transformation of the livestock sector in order to increase production and efficiency. The arid and semiarid lowlands, with vast area coverage and the majority of the world’s livestock population [41], have immense potential to increase livestock production and to help meet the world’s demand for animal food sources. Thus, because of climate-induced forces and the ever-increasing global demand for animal protein, a reorientation of the (agro) pastoral production system, from a subsistence orientation towards more commercially oriented production, seems inescapable [55].

Commercialization remains a widely pursued approach to improving food security in developing low-income regions, including the arid and semiarid lowlands. Theoretically, it appears that the ability of rural farming households to obtain income to purchase a variety of foods that they do not produce depends on the functioning of the market, where the income helps to stabilize consumption against seasonality [56,57]. Thus, it is implied that, given the desire of households for consumption bundles, they can undertake the production of such goods for autoconsumption, and/or specialize in the production of those goods at which they are relatively skilled—consuming some portion, and trading the surplus for the other goods and services they desire [58]. In light of this, pastoralists and agropastoralists are exchange-dependent for their food, where the trade in livestock in order to purchase cereals has become an integral part of livelihoods [4,5]. Thus, pastoralists and agropastoralists develop market interdependencies and economic interactions with cultivators [2,6]. This symbiosis leads them to become economically indistinguishable from their settled neighbors [7]. Hence, the improvement in the livelihoods of (agro) pastoralists is dependent on a system of markets [59], where they can bring their produce (e.g., livestock) to sell, and where they can buy nonpastoral foods in return [60,61].

Studies widely indicate that, in response to extreme environmental events, (agro) pastoralists are engaged with markets and towns to sell livestock and purchase grains [62]. Whereas pastoral production is oriented towards the pastoral culture/tradition (pastoralism), extreme environmental events nowadays have compelled pastoralists to develop a
'commercial mentality', and to orient their production towards markets. Pastoralists cannot subsist exclusively on animal food sources, which are generated by herds [31]. They smooth out their consumption through the market, as they have to obtain cereals to maintain a healthy diet. It is also evident that pastoralists are stressed by shocks, and, as a result, pure pastoralism, the state of subsisting exclusively on milk and animal blood, hardly exists anymore [25,63]. Consequently, (agro) pastoralists are largely supported by nonpastoral products. In this regard, Devereux [3] contends that pastoralists are engaged with markets and towns for selling livestock and buying grains. Similarly, Nunow [37] stresses the importance of markets because trade and exchange have enabled the pastoral system to survive and flourish for thousands of years. In an anthropological study, Reda [64] further emphasizes that pastoralists are drawn into the market to satisfy basic household requirements. Thus, food security among (agro) pastoralist communities is reliant on their ability to produce and/or purchase nonpastoral food grains [65], where livestock sales are the main source of income [66]. Studies, in this regard, consider that (agro) pastoralist communities are becoming more dependent on markets than crop farmers [3,62], and emphasize that (agro)pastoralists are increasingly turning to the market to meet basic household needs [64]. Therefore, ensuring enough food is not a sufficient condition for food unless access to it is guaranteed [67,68]. Such access to food is facilitated by the connections that both producers and consumers have to the markets [69]. This is where food security is theoretically linked to the market, whereby herders secure their food needs not only through their own production, but also through the connections they have to the market [9]. Pastoralism produces pastoral produce (e.g., milk) for household consumption, as well as offspring for sale, which is used for purchasing nonpastoral products [23]. Since nonpastoral food grains are not produced by pastoralists, they are subject to purchase from grain markets with the money earned mainly from the sale of pastoral outputs [66,70]. Hence, engaging in marketing practices becomes vital. Participating in marketing practices increases household income and, thus, increases the consumption of the composite category of nonpastoral foods, which results in higher dietary diversity and a food-secure status. Hence, the relationship between the market and food security is hypothesized as the integration into the market that influences food security in at least a couple of ways: First, it opens up demand for pastoral produce, and second, it builds purchasing power, thereby adding to total incomes. Since the food security of herders, in a given period, is a function of both their own production (animal food sources) and exchange (food grains) [9], the income from livestock sales helps them to purchase nonpastoral products, resulting in improved food security. Yet, the effect analysis and ‘commercial-orientation—food security’ relationship is a complex construct, in that the marketing of pastoral outputs is a function of a range of sociocultural, infrastructural, and production risk factors [23].

3. Materials and Method

3.1. Study Area Description

The Afar Region is one of the dominantly pastoral regions of Ethiopia. An estimated 90% of the region’s population depends on pastoralism: the herding of cattle, sheep, goats, and camels [71]. The region is characterized by an arid and semiarid climate, with low and erratic rainfall. The Afar Region is a large and sparsely populated dryland region in Ethiopia, and is with agricultural potential along the Awash river valley. Approximately half of the region consists of (semi) arid rangeland that can only sustain mobile livestock production. Even the higher rainfall areas of the region do not support reliable rain-fed agriculture [71]. The region is constituted into eight livelihood zones.

For this study, two livelihood zones, namely, the Aramis-Adaar pastoral zone, and the Asale agropastoral zone, were purposively selected (Figure 1). This was mainly due to their adjacency to the neighboring Amhara and Tigray regions, with better access to the market, and cultural variations between them. Aramis-Adaar is located within the Awash drainage system, in the southwestern quadrant of the region. Camels, cattle, sheep, and goats are the mainstays of the economy. It is the most populated livelihood zone in the
Afar Region, with an estimated 2017 population of 426,108 people [72], constituting more than half of the regional rural population. A large part of it is adjacent to the neighboring Amhara region, and depends on its markets for selling livestock and purchasing grains, and for access to the major markets (e.g., Bati, Kemissie, Sembete) in the Amhara region. In this zone, markets (livestock sale) play a dominant role in cash needs, where the food sources for all wealth groups are purchased cereals, in addition to livestock products from their own sources.

The second site, the Asale agropastoral livelihood zone, located in the northwest of Afar, consists of a number of noncontiguous areas within the larger geography of the Asale pastoral livelihood zone. Livestock husbandry (mainly cattle, sheep, and goats) is the main livelihood strategy, and the production of agricultural crops (mainly maize and sorghum) is rarely practiced. This zone is defined by its relationship with, and its connections to, the highlands of Tigray. The main markets in Tigray Region than in the Afar Region are accessible for selling livestock and for purchasing grains for this livelihood zone. The estimated 2017 population was 77,973 people [72].

3.2. Research Design

The aim of this study was to analyze the effects that a livestock commercial orientation would have on the food security positions of pastoral and agropastoral households. Identifying the social, cultural, and economic factors linked to both food security and a commercial orientation in the pastoral and agropastoral context, as well as the effects analysis, require a quantitative approach (a cross-sectional design) that seeks to process and scrutinize quantitative (survey) data. A survey strategy was used to address and propose potential explanations for the specific relationships between the variables used in the study by employing a structured questionnaire, based on interrogative techniques. Such questions are useful on issues where the interrogator expects a specific range of known responses [74]. The survey involved collecting information on various social, cultural,
and economic aspects, including livestock marketing practices in relation to food security achievement.

3.3. Data and Sampling

Quantitative data were collected from two livelihood zones of the Afar Region in Ethiopia, using a structured questionnaire. Data were collected on the various social, cultural, and economic characteristics thought to affect participation in livestock marketing practices and food security. In order to ensure the questionnaire’s face validity, it was pilot-tested on a sample of 11 cases, and the revised version was used as a guiding protocol [75]. The data gathering was assisted by graduate pastoral development workers, who are fluent in Afar and Tigigna. The enumerators were selected and trained for the purpose. A multistage purposive and random sampling procedure was employed to select the study settings and sample households. In the first stage, the Aramis-Adaar pastoral and Asale agropastoral livelihood zones were purposively selected for their adjacency to, and for their high market interactions with the neighboring Amhara and Tigray regions, respectively. This stage followed the random selection of two study sites from the northern and southern tips of Aramis-Adaar (which match parts of the Chefra and Dulecha districts), and the purposive selection of one spot (matching to the Aba’ala district) from Asale (Figure 1). Aba’ala was purposively selected following discussion with development workers, who informed us that it is a representative and predominantly agropastoral district of the Asale agropastoral livelihood zone. Then, it followed the random selection of kebeles proportional to the number of the sites, bearing a total of 13 kebeles for the study. Finally, it followed the random selection of 341 households, proportional to the sizes of the households in each kebele. We used the Yamane [76] formula to calculate the appropriate sample size for the study, adjusting the actual size to 341. (Out of a total of 341 households surveyed, 319 were used for the final analysis; some 22 recklessly filled out the questionnaire, and incomplete questionnaires were dropped.) The decision to rely on an adjusted smaller sample size rather than the one scientifically determined was taken because of the scattered settlements and the considerable degree of homogeneity in the pastoral and agropastoral characteristics [77].

3.4. Variables and Measurement

3.4.1. Outcome Variables

The levels of severity of food insecurity were measured using the household food insecurity access scale (HFIAS) [78] and the reduced coping strategy index (rCSI) which uses the five most common behavioral changes in response to food shortages [79]. The HFIAS and the rCSI were used in this study to measure the household stresses [80] and to reveal the indicators of the access component of food security [78], in terms of quantity, quality, and preference. These tools are proven to be correlated with the other food security measures (e.g., dietary diversity, caloric intake, or nutritional outcomes), as well as with the determinants of food security (e.g., income, food budgets/consumption expenditures, and asset data) [81]. The HFIAS, as a measurement instrument, follows a progression that begins with anxiety about food supply, followed by a decrease in the quality and quantity of food, and, finally, going to sleep hungry and going all day and night without eating [78]. The instrument is composed of nine Likert-scale questions (0 to 3 scale: 0 = none of the time, and 3 = often) about various characteristics associated with food access within the previous four weeks. The maximum score is 27, when the household responds ‘often’ to all of the questions, and the minimum is 0, when the household does not experience the occurrence and, hence, is within the range of 0–27. The higher the score, the more food insecure the household is in terms of access.

On the other hand, the rCSI measures how households manage shortfalls in food consumption [79]. It is an indicator of household food security behavior, and it asks a single question: ‘What do you do when you do not have enough food, and do not have enough money to buy food?’ [82]. It is composed of five Likert-scale questions (The original forms
of the CSI questions were reduced (hence, rCSI) to and contextualized as: 1. Eating less preferred foods; 2. Borrowing food/money from friends/relatives; 3. Limiting portions at meal times; 4. Limiting adult intakes; 5. Reducing number of meals per day. The rCSI has been identified as a more universal subset of coping behaviors [79], with varying weights (1, 2, 3, or 4, where 1 and 4 indicate the least and most severe categories, respectively, and 2 and 3 indicate the intermediate categories) about behaviors associated with food coping in the previous week. It results in discrete scores, depending on the household responses to all five questions (1 to 7 scale: 1 = never, and 7 = always) [80]. The higher the weighted sum scores, the greater the adoption of coping, and the higher the food insecurity level. We also used ‘per capita consumption expenditures’ in order to check for consistency in the effects.

3.4.2. Treatment Variable

Farm producers may take part in markets in different ways and forms. They used to sell farm produce (e.g., food grains, livestock, livestock products), as well as different types of goods and services (e.g., wage labor, land rents), and they also relied on credit with outsiders to smooth over their consumption and cash needs [83]. In such a case, different market regimes (net seller, net buyer, and autarkic) could appear [58]. This study, however, faces a scenario where the data suggests that all of the sample households engage in selling at least a portion of their production (livestock) for fulfilling cash needs; consequently, there are no observed nonparticipant groups, and no nonzero sales. Participation in marketing practices, in this case, is initiated in order to supplement the subsistence production by selling at least a minimum portion of their produce for cash income. Thus, it refers to the intensity of sales, in terms of either the sales volume or the sales value. Following Strasberg et al. [84], and Govereh and Jayne [85], given that all the households engage in selling at least a portion of their production, the development of a proxy is required, which captures the wide variation in terms of the intensities of the commercial-orientations across the sample. To address the potential shortcoming that the data do not fit into the participant–nonparticipant dichotomy, we resort to the concept of ‘commercial orientation’, in which households can be segregated between the commercially oriented (‘high’) and the subsistence-oriented (‘less’), on the basis of the intensity of the sales participation, where cases would lay somewhere on the ‘commercial–subsistence’ continuum. The livestock commercial orientation was measured in terms of the scale adopted from Bekele et al. [54], Strasberg et al. [84], Govereh and Jayne [85], and von Braun [44]. To measure the effects, we turn to defining “household livestock commercialization” (The commercialization of the pastoralist economy could take several forms, including an inclination of production toward cash-stocks (small-stocks), where small-stocks outnumber large-stocks, resulting in production with an increased marketed surplus, an increased use of the purchased livestock production inputs, such as purchased feed and veterinary medicine, or involvement in nonpastoral employment (e.g., petty trade) [52]. However, the survey data indicate that no evidence on the latter two types of commercialization was obtained. As a result, this study defines “livestock commercial orientation” as the level of production that is devoted to sales at the primary (local market centers, hence, local commercialization, or the proportion of sales to consumption) index (HCI)—an index that measures the proportion of the total herd size sold to the total owned. The larger the index, the higher the degree of commercialization. However, comparison here is not between pure market-orientation and subsistence, but between households with ‘less’ or ‘higher’ market orientations, in the sense that ‘pure market-orientation and subsistence’ are not the case in the study area, as the data suggest. Thus, participation in livestock marketing practices, measured using the degrees of commercial-orientation, was used as a treatment variable to estimate the food security effects of the market.

3.4.3. Covariates

A range of variables determine the marketing of pastoral outputs, as well as pastoral and agropastoral food security. Studies have identified a range of social, cultural, and
economic causes contributing to the lower levels of food security among (agro) pastoral communities [86]. For example, an empirical study, conducted to identify the determinants of food security among agropastoral communities, found that the climate and climate-change-induced hazards are the main causes of food insecurity, followed by market and service problems, and human factors [86]. Mayanja et al. [87], on the other hand, found that livelihood systems, livestock holdings, an involvement in social networks, and land holdings used to explain the food security among (agro) pastoral communities. Similarly, Siraje and Bekele [88] found that herd size, income from livestock production, and nonfarm income were positively associated with food security levels. Still another study identified livestock ownership (herd size), sex, family size (adult equivalent), and the mother’s time constraints as significant factors determining food insecurity [36]. In addition to the size of resources owned, such as farmland and livestock, peace and security also influence food security among the (agro) pastoralist communities [35]. With regard to the determinants of (agro) pastoralist commercialization, on the other hand, Babu [89], Catley et al. [23], Rueff and Rahim [60], and Tessema et al. [90], among others, are mentioned foremost, as they have identified market-discouraging norms, household characteristics, and rural infrastructures, among others, as determinants of (agro) pastoralist commercial orientations. Thus, drawing on a myriad of empirical evidence, this study relied on groups of social, cultural, economic, infrastructural, and production risk factors as the covariates, determining both the outcomes and the treatment variables (Table 1).

Table 1. Operationalization and measurement of variables.

| Variables                     | Definition                                                                 | Measurement | Min/Max (Denoting the Minimum and Maximum Values of the Continuous Variables. For the Dummy/Categorical Variables, the Values 0, 1, or 2 Are Arbitrarily Assigned to Represent Presence/Absence, or Else, to Denote Walking Hour, or Frequencies.) | A Priori Expectation | Sources |
|-------------------------------|---------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------|----------------------|---------|
| Livelihood zone               | 1 = Asale, 0 = Aramis-Adaar                                            |             |                                                                                  |                      | [23,35,36,60,86–90] |
| Age                           | Age of household head                                                     | Number of years | 30 (80)                                                                         | (+)                  |         |
| Family size                   | Family size                                                               | Number      | 2 (11)                                                                          | (−)                  |         |
| Livestock wealth              | Herd size in household                                                    | TLU         | 0.70 (105.3)                                                                    | (+)                  |         |
| Livestock purpose, for        | Keeping livestock for the purpose of accumulation                       | 1 = yes; 2 = no | (−)                                                                              |                      |         |
| accumulation                  |                                                                          |             |                                                                                  |                      |         |
| Livestock purpose, for        | Keeping livestock for the purpose of consumption                         | 1 = yes; 2 = no | (−)                                                                              |                      |         |
| consumption                   |                                                                          |             |                                                                                  |                      | [23,35,36,60,86–90] |
| Livestock slaughters           | Number of livestock slaughtered for rituals                               | TLU         | 0 (3.6)                                                                         | (−)                  |         |
| Marketing costs               | LS marketing costs                                                       | ETB         | 10.00 (850.00)                                                                  | (−)                  |         |
| Distance to town/market/road  | Walking times to the nearest town/market/road                            | 1 = 1 h or more, 0 = less than 1 h | (−)                                                                              |                      |         |
| Extension                     | Frequency of visits by extension agents/workers                           | 1 = 3 times or more, 0 = once or twice | (−)                                                                              |                      |         |
| Credit accesses               | Credit services                                                           | 1 = yes; 2 = no | (−)                                                                              |                      | (+)     |
### Table 1. Cont.

| Variables                  | Definition                                                                 | Measurement          | Min/Max (Denoting the Minimum and Maximum Values of the Continuous Variables. For the Dummy/Categorical Variables, the Values 0, 1, or 2 Are Arbitrarily Assigned to Represent Presence/Absence, or Else, to Denote Walking Hour, or Frequencies.) | A Priori Expectation | Sources |
|----------------------------|----------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------|
| Guro/mobility              | Moving along with LS                                                       | 1 = yes; 2 = no      | (--)                                                                                                                                                                                             | (--)                 |         |
| Clan consent               | Clan consent to sell LS                                                   | 1 = yes; 2 = no      | (--)                                                                                                                                                                                             | (--)                 |         |
| Sanction paying            | Sanction pays in LS                                                       | 1 = yes; 2 = no      | (--)                                                                                                                                                                                             | (--)                 |         |
| Livestock sharing          | Livestock sharing                                                         | 1 = yes; 2 = no      | (--)                                                                                                                                                                                             | (--)                 |         |
| Food purchases             | Food coping through food purchases                                        | 1 = yes; 2 = no      | (+)                                                                                                                                                                                              | (+)                  |         |
| Food sharing/borrowing     | Food coping through food sharing/borrowing                                 | 1 = yes; 2 = no      | (+)                                                                                                                                                                                             | (+)                  |         |
| Non-livestock incomes      | Incomes obtained from nonpastoral activities                               | ETB                  | 0 (19,500.00)                                                                                                                                                                                  | (+)                  |         |
| Dagueing                   | Dagueing as info source                                                   | 1 = yes; 2 = no      | (+)                                                                                                                                                                                             | (+)                  |         |
| Market visiting            | Market visits as info source                                              | 1 = yes; 2 = no      | (+)                                                                                                                                                                                             | (+)                  |         |
| Livestock deaths           | Occurrences of LS deaths                                                  | 1 = yes; 2 = no      | (--)                                                                                                                                                                                             | (--)                 |         |
| Conflicts                  | Occurrences of conflict                                                   | 1 = yes; 2 = no      | (--)                                                                                                                                                                                             | (--)                 |         |

TLU = tropical livestock unit; ETB = Ethiopian Birr (currency); LS = livestock.

#### 3.4.4. Operationalization and Measurement of Variables

The operationalization and measurement of the variables used in this study are shown in Table 1.

#### 3.5. Data Analysis Techniques

The analysis followed both descriptive and econometric procedures. The descriptive characteristics are presented as percentages, means, frequency distributions, and standard deviations. We measured the households’ participation in livestock marketing practices, using the degrees of commercial orientation (treatment variable), in order to estimate the food security effects of the market. We divided the households between ‘commercial’ and ‘subsistence’, on the basis of their HCI scores, which resulted in treatment and control groups. Then, comparisons based on the covariates were performed using the chi-squared test ($\chi^2$-test) and t-statistics ($t$-test). To increase the efficiency of the estimates and to control for potentially remaining differences in the observable characteristics [91], the propensity score matching (PSM) technique was used to estimate the effects of the market. The basic idea of employing PSM in this study was to find in the group of subsistence-oriented households, those households that were similar to the commercially oriented ones in all of the relevant baseline characteristics, which would serve as valid substitutes for the missing counterfactuals. PSM assumes that, after controlling for all of the subsistence household and baseline characteristics that are correlated with commercial orientations and the outcome variables, the commercially orientated households would have the same average outcomes as the subsistence households would have had had they been commercialized.
This does not mean that the differences in the outcomes for the control (‘subsistence’) and treatment (‘commercial’) groups are attributed to baseline characteristics, but only for the treatment group, i.e., the commercial orientation. In other words, it helps to suitably match subjects on the basis of a single-index balancing score (by identifying matching partners), rather than on baseline characteristics, as in traditional evaluation techniques, and this is preferred over parametric models for relaxing randomization [92]. Thus, the analysis followed that randomly selected commercially orientated households (the so-called ‘treatment’ groups) are matched with similar ‘subsistence’ counterparts (‘control’ groups), and the difference in the mean outcome indicators is statistically evaluated in a step-wise procedure: a propensity scores estimation, choosing the best-matching algorithm, checking for overlap, matching quality assessments, and the treatment of the effect estimation [93]. We employed the widely used logit model (The model specification is a good fit; it was assessed with the Hosmer–Lemeshow test \( p\)-value = 0.6231)) to estimate the propensity scores: the conditional probability of a household participating in livestock sales given its observable characteristics, in which the commercialization degree is regressed on the observed baseline characteristics [92]. Hence, the propensity scores are the predicted probability of the treatment derived from the fitted regression model. Then, the average treatment effect on the treated (ATT) was calculated [93]. Accordingly, the commercial-oriented and subsistence households were matched on the propensity scores. These scores were used to select comparison households, through the best matching estimator that yielded the best balances [94,95]. In this study, the best-matching algorithm was selected on the basis of the after-matching results of a large matched sample size, a large number of insignificant variables, a small pseudo-\( R^2 \), and a small remaining mean standardized bias [96]. Widely used matching estimators of the nearest neighbor, with and without replacement, radius matching with different caliper sizes, and kernel matching with different bandwidths, were tested in terms of the set criteria from which to choose the best matching estimator. Standardized bias (SB), defined as the difference of the sample means in the treated and control subsamples as a percentage of the square root of the average of the subsample variances for each covariate, was used to evaluate the matching quality [97], guided by 3–5% mean bias as the sufficient tolerance level of the remaining bias after matching [93]. Stata version 14 was used to analyze the data.

3.6. Reliability and Validity of the Data

The two livelihood zones—the pastoral and the agropastoral (Figure 1)—were included in this study because it was assumed that considering different livelihood zones would optimize the variations and ensure an equal representation of the study participants. The use of representative groups of pastoralists and agropastoralists helps the data to become more generalizable and reliable [98]. The decision on which livelihood zones to include as the target populations was made after consulting with experts from the regional bureau of pastoral development, who confirmed that the two zones chosen were fairly representative.

3.7. Ethical Considerations

In this study, basic ethical research considerations were taken into account. In order to minimize biases in selecting the study kebeles, in consultation with the enumerators and the experts, the kebeles were first coded as ‘road-side’, ‘mid-distance’, and ‘distant’ on the basis of their access to main roads and different service centers. From the three coded groups, the study kebeles were random selected. Through the recruited local guides (facilitators), permission from local authorities and respective clan elders was received to enter into the interview sites. Then, households were randomly picked for the interviews. Prior to the commencement of the interview, respective interviewers shared information (dague) (The institution of a traditional information exchange system among the Afar (for a detailed account on dague, see also Reda [64]) with each interview participant on the purpose of the study. Through the dague, in order to ensure their privacy, the participants
were preinformed about the voluntary nature of their participation in the interview, and that they could skip questions that they did not want to answer, or withdraw freely from participation at any stage of the interview [74]. The participants were asked for their consent in writing (On the first page of the survey questionnaire, a short code of ethics—a consent statement that included anonymity, confidentiality, right to privacy, and data protection—was issued and duly explained to each interview participant), and they were assured of the confidentiality of the information they shared with the researcher, and that their anonymity, and responsibility in the analysis of the data and the reporting of the findings, would be maintained. Furthermore, the sources of ideas, opinions, or information used in any form in producing the manuscript properly are cited inside the text and are listed in the references.

4. Results
4.1. Descriptive Results

The descriptive statistics presented in Table 2 compare the commercially oriented samples with the subsistence households in terms of baseline characteristics, using the \( t \)-test for continuous variables, and the \( \chi^2 \)-test for categorical variables. The test statistic results indicate that commercially oriented households are statistically similar, on average, to the subsistence households in some variables, including family size, livelihood strategies, extension service frequencies, food coping mechanisms (food purchases), conflicts, paying sanctions, access to credit, and livestock deaths. However, there appear to be considerable differences between the commercially oriented samples and the subsistence households in terms of the severity of food insecurity, the coping strategy indices, the per capita consumption expenditures, ages, livestock sales volumes and sales incomes, herd sizes, clan consent for selling livestock, market inaccessibility, slaughtering livestock for ritual purposes, total costs of food purchases, nonlivestock incomes, food sharing as a coping strategy, and the intentions to devote livestock to the purpose of accumulation.

It is evident from the results (Table 2) that commercially oriented households have relatively smaller scores/indices, in both the HFIAS and rCSI measures. The \( t \)-test values with regard to the HFIAS \((p < 0.1)\) and the rCSI \((p < 0.05)\) scores/indices also reveal that commercially oriented and subsistence households are significantly different. A significant difference \((p < 0.05)\) between commercially oriented and subsistence households is also seen in terms of the per capita consumption expenditures. Contrary to our expectation, however, commercially oriented households spent nearly 15% less (than their subsistence counterparts) on nonpastoral food grains. This might be because they allocated a greater proportion of their sales income to nonfood consumption, rather than to food purchases. Subsistence households are wealthier in terms of herd sizes, as they own larger sizes (about 44% bigger) than commercially oriented households, which might be due to their tendencies towards accumulating rather than selling. They are less likely to convert livestock wealth into cash to support consumption through the purchases of nonpastoral food grains, and they tended to cope with food shortages by sharing. The findings also suggest that subsistence households are older and more oriented to pastoralist traditions in cultural practices, such as ritualization (the mass slaughtering of livestock for ritual purposes), and the adherence to traditional administration (clan consent for selling livestock) holds them back from market production. The sales volumes and total livestock sales incomes for commercially oriented households are greater (by over 40 and 35%, respectively) than they are for the subsistence households. Furthermore, commercially oriented and subsistence households are significantly different \((p < 0.01)\) in terms of the distances from market centers, measured in walking hours.
Table 2. Baseline characteristics of households by commercial orientation.

| Baseline Characteristics | Commercial Orientation | Total | t-value |
|-------------------------|------------------------|-------|---------|
|                         | Commercial (N = 64)    | Subsistence (N = 255) |       |
| **Continuous variables**|                        |       |         |
| HFIAS (household food insecurity access score) | 9.52 (4.99) | 10.53 (4.76) | 9.72 (4.82) | -1.8 * |
| rCSI (reduced coping strategy index) | 10.78 (4.01) | 12.76 (3.24) | 11.72 (3.40) | -2.05 ** |
| Per capita consumption expenditure, ETB | 595 (450) | 699 (471) | 678 (468) | 2.6 ** |
| Livestock sales volume, TLU | 3.03 (1.84) | 1.78 (1.40) | 2.02 (1.58) | -5.99 *** |
| Total livestock sales income, ETB | 25,380 (18,042) | 16,316 (976) | 18,134 (16,485) | -4.05 *** |
| Livestock wealth, TLU | 7.8 (5.3) | 13.9 (11.5) | 12.69 (10.84) | 4.15 *** |
| Age, in years | 46.97 (7.4) | 49 (8.7) | 48.6 (8.5) | 1.7 * |
| Family size | 6.2 (1.5) | 6.5 (1.6) | 6.4 (1.6) | 1.3 |
| Livestock slaughters, TLU | 0.39 (0.56) | 0.54 (0.5) | 0.42 (0.52) | -2.1 ** |
| Total cost of food purchases, ETB | 4332 (2779) | 3466 (2362) | 4158 (2719) | 2.3 ** |
| Nonlivestock incomes, ETB | 420 (1618) | 1113 (2395) | 974 (2276) | 2.3 ** |
| **Dummy variables** |                        |       |         |
| Livelihood zone (Asale = 1, Aramis = 0) | 0.44 | 0.54 | 0.52 | 2.04 |
| Food coping by sharing (yes = 1, no = 0) | 0.02 | 0.11 | 0.03 | 11.4 *** |
| Food coping by purchases (yes = 1, no = 0) | 0.69 | 0.62 | 0.64 | 0.90 |
| LS purpose for consumption (yes = 1, no = 0) | 0.56 | 0.61 | 0.60 | 0.44 |
| LS purpose for accumulation (yes = 1, no = 0) | 0.16 | 0.25 | 0.23 | 4.30 ** |
| Extension (3x or more = 1, 1 or 2x = 0) | 0.22 | 0.20 | 0.22 | 0.08 |
| Market distances (>1 h = 1, 1 h or less = 0) | 0.36 | 0.58 | 0.54 | 10.05 *** |
| Market visits as info source (yes = 1, no = 0) | 0.53 | 0.58 | 0.57 | 0.60 |
| Dagueing as info source (yes = 1, no = 0) | 0.36 | 0.27 | 0.29 | 2.50 |
| Conflicts (yes = 1, no = 0) | 0.13 | 0.19 | 0.18 | 1.57 |
| Sharing livestock (yes = 1, no = 0) | 0.31 | 0.34 | 0.33 | 0.14 |
| Paying sanctions in LS (yes = 1, no = 0) | 0.09 | 0.11 | 0.10 | 0.14 |
| Guro/mobility (yes = 1, no = 0) | 0.31 | 0.31 | 0.31 | 0.01 |
| Clan consent for selling (yes = 1, no = 0) | 0.60 | 0.63 | 0.60 | 3.18 *** |
| Access to credit (yes = 1, no = 0) | 0.41 | 0.38 | 0.41 | 0.50 |
| Livestock deaths (yes = 1, no = 0) | 0.33 | 0.34 | 0.34 | 0.02 |

Source: Survey data, 2019; *** p < 0.01, ** p < 0.05, * p < 0.1; figures for continuous variables are means (SDs); for dummy variables, the proportion of households assuming the value, 1; TLU = tropical livestock unit; LS = livestock; ETB = Ethiopian Birr (currency).

4.2. Econometrics Results

4.2.1. Market Production and Its Determinants

The likelihood ratio in our logit model is significant at a <1% probability level. The goodness of fit is measured by counting the $R^2$, and the model result shows that the correctly predicted percent of sample households is 83%, indicating that the model has predicted the groups fairly correctly (See Table 3 and Appendix A: Confusion Matrix). The variables including livestock wealth were measured in the TLU of the herd owned, market inaccessibility was measured in the walking hours to the market/road/town, the occurrences of livestock deaths, due to either drought, disease, or conflict, the access to credit, livestock sharing/transfers, and slaughters as social and cultural obligations, moving along with livestock (guro), and devoting herds to the very purpose of accumulation and personal consumption are statistically significant factors associated with the intensity of participation in livestock sales. The marginal effect value corresponding to livestock wealth suggests that a TLU increase in herd size causes a decrease in the probability of commercial orientation by about 22%. Similarly, the probability decreases by more than 10 percentage points as a result of the owners’ tendencies toward personal consumption or accumulation rather than selling. As is also evident from the descriptive results, subsistence-oriented...
groups hold larger herd sizes than the commercially oriented groups (Table 2). The large herd sizes of some households mean that they prefer to accumulate large herds in order to signal honor, or to devote to personal consumption rather than trading. They believe that livestock are indicators of prestige and wealth in the community.

Table 3. Logit regression for commercialization degree.

| Commercialization                          | Coefficient | St. Err. | t-Value | Marginal Effect |
|--------------------------------------------|-------------|----------|---------|-----------------|
| Livestock wealth, TLU                      | −2.15 **    | 0.376    | −5.72   | −0.220          |
| Livelihood zone                            | 0.117       | 0.726    | 0.16    | 0.012           |
| Extension service                          | 0.195       | 0.231    | 0.84    | 0.020           |
| Age, years                                 | −0.017      | 0.024    | −0.70   | −0.002          |
| Family size                                | −0.082      | 0.124    | −0.66   | −0.008          |
| Food coping, sharing                       | 0.383       | 0.894    | 0.43    | 0.045           |
| Food coping, purchase                      | 0.02        | 0.423    | 0.05    | 0.002           |
| Livestock slaughters, TLU                  | −0.789 **   | 0.341    | 2.32    | −0.080          |
| Livestock purpose, consumption             | −1.036 **   | 0.444    | −2.33   | −0.116          |
| Livestock purpose, accumulation            | −1.238 *    | 0.655    | −1.89   | −0.100          |
| Distance to town/market/road               | −0.603 ***  | 0.187    | 3.23    | 0.061           |
| Paying sanctions                           | −0.654      | 0.593    | 1.10    | 0.082           |
| Conflicts                                  | −0.801      | 0.554    | −1.45   | −0.068          |
| Guro/mobility                              | 0.958 *     | 0.526    | 1.82    | 0.114           |
| Clan consent for livestock selling         | −0.314      | 0.524    | −0.60   | −0.033          |
| Nonlivestock incomes                       | 0.0002      | 0.0001   | 1.50    | −0.0001         |
| Sharing livestock                          | −3.616 **   | 1.624    | −2.23   | −0.291          |
| Access to credit                           | 0.99 **     | 0.435    | 2.28    | 0.109           |
| Livestock marketing costs                  | −0.001      | 0.001    | 1.12    | −0.000          |
| Source info, market visit                  | 0.664       | 0.593    | 1.12    | 0.066           |
| Source info, Dague                         | 0.906       | 0.708    | 1.28    | 0.107           |
| Livestock deaths                           | −3.717 **   | 1.624    | 2.29    | −0.570          |
| Constant                                   | 1.127       | 1.974    | 0.57    |                 |

Pearson $\chi^2$ 90.11 *** Log likelihood $\chi^2$ −114.85

% correctly predicted (Count $R^2$) 83% Sample size 319

Source: Survey data, 2019; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; TLU = tropical livestock unit.

In terms of the distances to towns/markets/roads, the marginal effect value confirms that households that are one walking hour further away from market centers are less likely to become commercially oriented, where their probability of commercial orientation decreases by about 6%. This means that the greater the distance to the market, the less likely the household’s orientation towards the market. Proximity to all-weather roads, markets, and towns encourages commercial orientations because of the effect on reducing costs, such as time and transport costs. The distance to markets often influences marketable volumes as well as local market pricing conditions. The households located far away in remote villages experience higher marketing costs than those closer to the markets. The results further reveal that the more that households are traditionally oriented, the less likely they tend to be commercially oriented. This has been attested to in the results of market-discouraging norms, such as devoting herds to the purposes of accumulation and/or personal consumption, livestock slaughters for ritual purposes, and livestock transfers. Evidently, for instance, the likelihood of a commercial orientation declines by 8 and 29% for every additional TLU of livestock slaughtered for ritual purposes, or shared with neighbors or relatives to fulfill social and cultural obligations, respectively. Furthermore, production risk factors, such as livestock deaths, due to either disease or conflict, impede commercial
orientations. Our results in this regard confirm that livestock deaths cause the probability of adopting a commercial orientation to decline by as much as 57%.

Similarly, livestock mobility impacts livestock marketing practices positively and significantly at less than a 10% level of significance. In the pastoralist setting, it is a common practice to move along with livestock, where mobility enables the use of as yet unexploited pastures and water sources [31]. This helps pastoralists to escape the exhausted resources in their permanent base villages, and to take advantage of the opportunities of resource abundance elsewhere. Mobile herders can also obtain better access to, and interactions with buyers along the moving routes, as it might be easy and inexpensive to trade livestock over large distances [31]. Better access to, and interactions with buyers along the moving routes could attract pastoralists to the market, which, in turn, promotes market production. However, it has to be noted that, while mobility is a risk-managing and coping strategy, market facilities across the moving routes and the guro terminus hardly exist. They move farther away from the base villages, near which market centers are set, which often means that the value of livestock falls, fetching them poor prices. Moreover, the costs and risks associated with guro, such as inter- and intra-clan and ethnic conflicts, animal theft and raids, long hours of trekking, (labor) costs, and uncertainties, are persistent [99]. Therefore, our results demonstrate a positive relationship between mobility and market production, which provides better market access along the moving routes and the guro terminus, as well as no, or at least reduced, risks and costs constraining mobility.

4.2.2. Propensity Score Estimation and Choosing a Matching Algorithm

The results of the covariate balancing test before and after matching, using nearest neighbor matching (NNM) with and without replacement, caliper matching with different radii, and kernel matching with different bandwidths, are presented in Table 4. The average standardized bias difference for all the covariates, of 19.6 before matching, is reduced to about 7.2 and 7.3 for NNM (with and without replacement, respectively); 4.8 for Radius 0.06, 4.2 for 0.08, and 3.8 for 0.1; and 4.1, 4.7, 6.9, and 10.7 for the kernel bandwidths, 0.08, 0.1, 0.25, and 0.5, respectively, after matching. Similarly, the pseudo-$R^2$ also dropped significantly, from 0.285 before matching to as low as 0.01 for radius matching with Radius 0.1, after matching. The $p$-values of the likelihood tests show that the joint significance tests of the covariates could not be rejected before matching but could be after matching. The low mean standardized bias and insignificant $p$-values of the likelihood test after matching imply that the proposed specification of the propensity score was successful in balancing the distribution of the covariates between the commercial and subsistence-oriented households. Following Caliendo and Kopeinig [93], the best matching algorithm chosen was that with a large matched sample size, a large number of insignificant variables after matching, a small pseudo-$R^2$ after matching, and a small mean standardized bias. The results from the performance of the matching estimators (Table 4) indicate that the radius-matching estimator with Radius 0.1 is the best matching estimator satisfying the set criteria. The basic idea of radius matching is to use not only the nearest neighbor within each caliper, but also all of the comparison members within the caliper. A benefit of this approach is that it uses only as many comparison units as are available within the caliper, and it therefore allows for the usage of extra (fewer) units when good matches are (not) available. Hence, it avoids the risk of bad matches [100]. Moreover, prior to matching, the mean estimated propensity scores for the commercial and subsistence households were, respectively, 0.431 and 0.143.
Table 4. Performance of matching estimators.

| Matching Estimators     | Number of Insignificant Variables after Matching | Pseudo-R² after Matching | Matched Sample Size | Mean SB |
|-------------------------|-------------------------------------------------|--------------------------|---------------------|---------|
| Nearest neighbor matching |                                                |                          |                     |         |
| Nearest neighbor with replacement | 22 | 0.021 | 314 | 7.2 |
| Nearest neighbor without replacement | 22 | 0.032 | 314 | 7.3 |
| Caliper matching         |                                                |                          |                     |         |
| Radius 0.06              | 22                                              | 0.014                    | 316                 | 4.8     |
| Radius 0.08              | 22                                              | 0.012                    | 316                 | 4.2     |
| Radius 0.1               | 22                                              | 0.010                    | 317                 | 3.8     |
| Kernel matching          |                                                |                          |                     |         |
| Bandwidth 0.08           | 22                                              | 0.014                    | 316                 | 4.7     |
| Bandwidth 0.1            | 22                                              | 0.011                    | 317                 | 4.1     |
| Bandwidth 0.25           | 22                                              | 0.025                    | 319                 | 6.9     |
| Bandwidth 0.5            | 22                                              | 0.078                    | 319                 | 10.2    |

Source: Computations from survey data, 2019.

Because of the inability to find sufficiently good matches, two commercially oriented households were lost from the original sample of 319 after matching. After matching, there was a negligible difference in the mean propensity scores of the two groups, 0.41 for the commercial group versus 0.40 for the matched control subsistence group, implying that a proper balance was maintained. The outputs of the standardized differences show that before matching, in almost all the covariates, the means in the commercial and subsistence groups were different and were statistically significantly different in 13 of the 22 cases (Table 2). After matching (radius matching, Radius 0.1), however, the balance was markedly better on all the variables, whereby no cases of statistical significance after matching suggest that the balance was maintained (Table 4). As is evident from Table 5, although most of the covariates are well balanced, the requirement of a % bias after matching was <5% [97] partially fulfilled. Some variables had a % bias >5% after matching but were not extremely high (all cases <10%). The overall matching performance is good: after matching, the average % bias was 3.8, and the t-test was insignificant in all cases, and there was a % bias < 5% for all covariates, with few exceptions (showing a small imbalance of as high as 9.6%). In almost all cases, it is evident that the sample differences in the raw data significantly exceed those in the samples of the matched cases. Thus, the process of matching creates a high degree of covariate balance between the treatment and control samples that are used in the estimation.

A visual inspection of the graph of the standardized differences and density distribution of the estimated propensity scores for the two groups, after radius matching with Radius 0.1, also confirm the sufficiency of the balance of the covariates after matching (Figures 2 and 3). Overall, the results suggest that the matched samples were adequate for performing the effect analysis. Hence, the matching was effective in building fairly good control group and was used to estimate the average treatment effect on the treated (ATT) group of the market participation on the outcome.
Table 5. Balance between treated and untreated before and after radius matching, Radius 0.1.

| Confounders                      | Mean, Commercial | Mean, Subsistence | Standardized %Bias | t-Test |
|---------------------------------|------------------|-------------------|--------------------|--------|
|                                 | UM M M | UM M M | UM M | %reduc | UM M |
| Livestock wealth, TLU           | 1.83 1.87 | 1.90 2.30 | 2.39 2.90 | −80.5 24.0 | 94.1 94.5 | −5.72 *** | −8.24 |
| Livelihood zone                 | 0.44 0.45 | 0.48 0.54 | 0.54 0.61 | −22.7 4.1 | 92.4 92.7 | −1.92 * | −2.44 |
| Extension services              | 3.06 3.05 | 3.05 3.08 | 3.05 3.08 | −5.4 8.8 | 18.1 15.6 | 0.24 | 0.17 |
| Age, year                       | 46.97 47.16 | 47.68 49.00 | 49.00 50.80 | −25.1 6.7 | 54.4 47.4 | −1.51 * | −2.98 |
| Family size                     | 6.20 6.19 | 6.17 6.49 | 6.49 7.01 | −18.9 4.9 | 24.1 23.3 | 0.04 | 0.12 |
| Food coping, sharing            | 0.11 0.081 | 0.060 0.02 | 0.02 0.00 | 36.9 8.6 | 76.7 71.9 | 3.43 *** | 0.45 |
| Food coping, purchase           | 0.69 0.71 | 0.62 0.19 | 0.19 0.09 | 13.4 0.0 | 99.7 94.0 | 0.95 | 0.00 |
| Livestock slaughters             | 0.54 0.54 | 0.53 0.39 | 0.39 0.19 | 28.6 1.7 | 94.2 90.8 | 2.11 ** | 0.07 |
| Source info, LG                 | 0.56 0.56 | 0.58 0.61 | 0.61 0.72 | −9.2 2.4 | 73.8 71.4 | −0.66 | −0.13 |
| Source info, dague              | 0.16 0.16 | 0.17 0.25 | 0.25 0.32 | −22.7 1.7 | 92.4 92.7 | −1.55 | −1.10 |
| Market access                   | 3.05 3.05 | 2.95 2.59 | 2.59 2.87 | 44.4 9.6 | 78.4 76.6 | 3.15 *** | 0.52 |
| Paying sanctions                | 0.11 0.097 | 0.113 0.09 | 0.09 0.08 | 5.0 5.5 | −5.3 5.8 | 0.37 | 0.30 |
| Conflict                        | 0.13 0.113 | 0.129 0.19 | 0.19 0.26 | −18.4 4.5 | 75.7 70.8 | −1.25 | −0.28 |
| Mobility                        | 0.313 0.290 | 0.295 0.305 | 0.305 0.318 | 1.4 0.9 | 36.4 35.2 | 0.10 | −0.05 |
| Clan consent for selling LG     | 0.63 0.612 | 0.594 0.60 | 0.60 0.61 | 5.9 4.0 | 32.9 32.6 | 0.42 | 0.22 |
| Non-livestock incomes           | 420 434 | 503 1113 | 1113 2226 | −33.9 3.4 | 89.9 87.5 | −2.19 ** | −0.25 |
| Sharing livestock               | 0.31 0.323 | 0.331 0.34 | 0.34 0.35 | −5.3 1.7 | 67.2 70.0 | −0.37 | −0.10 |
| Access to credit                | 0.375 0.387 | 0.416 0.424 | 0.424 0.432 | −9.9 5.8 | 40.8 39.6 | −0.70 | −0.32 |
| Livestock marketing costs       | 237 239 | 248 211 | 211 203 | 17.0 5.8 | 66.0 65.2 | 1.22 | −0.28 |
| Source info, market             | 0.53 0.533 | 0.535 0.58 | 0.58 0.61 | −10.6 0.5 | 94.8 97.3 | −0.27 | −0.03 |
| Source info, dague              | 0.375 0.371 | 0.341 0.275 | 0.275 0.259 | 21.5 6.3 | 70.7 65.8 | 1.58 | 0.34 |
| Livestock deaths                | 0.328 0.339 | 0.346 0.337 | 0.337 0.342 | −1.9 1.5 | 22.9 22.4 | −0.14 | −0.08 |

Source: Survey data, 2019; *** p < 0.01, ** p < 0.05, * p < 0.1.

Figure 2. Standardized differences before and after matching. Source: computations from survey data, 2019.
Once a propensity score has been calculated for each observation, an important step in investigating the validity and performance of the PSM estimation is the verification of the common support, ensuring that there is overlap in the range of propensity scores across the treatment and comparison groups. No inferences about the treatment effects can be made for a treated individual for whom there is not a comparison individual with a similar propensity score.

The common support was subjectively assessed by examining a graph of the propensity scores across the treatment and comparison groups. The overlap of the distribution of the propensity scores across the treatment and comparison groups is displayed in Figure 3. The extent of the overlap is satisfactory and the balancing property is satisfied, as is evident from the output. Next, we checked the balancing of the propensity scores and covariates using the selected matching algorithm (radius matching). In this study, the balancing power of the estimation was ascertained by the reduction in the mean standardized bias after matching.

Figure 3. Distribution of propensity scores across treatment and comparison groups. Source: computations from survey data, 2019.

4.2.3. Matching Quality

Table 6 depicts that the SB was reduced from 19.6% before matching, to 3.8% after matching, with an 80.6% bias reduction, with the mean bias after matching within the acceptable range of 3–5% for the remaining bias after matching [92]. The number of cases lost to the common support restrictions was two (below 1%), which is fairly low [101,102]. Hence, the exclusion of few observations, combined with the low remaining standard bias, the low pseudo-$R^2$ after matching, and the high reduction rates of the mean SB, produce good matching results and the matching quality attained was fairly good. These results suggest that all of the covariates used to generate the propensity scores were well balanced after matching.
Table 6. Summary of matching quality indicators.

| Commercial/subsistence | SBBefore (%) | SBAfter (%) | % SB Reduction | Cases Lost to CS | Pseudo-$R^2$ |
|------------------------|--------------|-------------|----------------|-----------------|--------------|
| Commercial/subsistence | 19.6         | 3.8         | 80.6           | 2               | 0.010        |

Source: Computations from survey data, 2019.

4.2.4. Estimating Effects of Livestock Marketing Practices

The average treatment effect on the treated (ATT) households is the estimated average effect of livestock marketing on the food security of individuals, who are identified as more commercially oriented. The estimation (Table 7) shows that, corresponding to the prevalence of household food insecurity, a significant negative treatment effect on the treated households, of 0.41, appeared. That is, the prevalence of household food insecurity, measured in the HFIAS, of commercially oriented households was 41 percentage points lower than that of the matched control subsistence-oriented group members. Similarly, with respect to coping strategies, the treatment effect on the treated households was found to be negative and significant at a 10% significant level. Evidently, commercially oriented households achieve lower food coping strategy indices in periods of food shortages than the matched control subsistence groups, by 91%. The results indicate that more commercially oriented households can benefit more than subsistence-oriented households do, in terms of food security, from selling livestock for increased purchasing power. The increased sales income helps them to purchase food grains to supplement consumption, thereby helping them to diversify their diets and achieve food security. On the other hand, subsistence groups usually find it harder to maximize the benefits from markets, mainly because of their orientations toward pastoral traditions, where they tend to devote their holdings to accumulation or use for cultural festivities, ending up with lowered sales incomes, falling short of sufficiently supporting their consumption needs, and, hence, presenting lower food security levels.

Expenditures on food was also used as an indicator to assess whether there were livelihood improvements due to the commercial orientation. As can be seen from the estimation outputs, before matching, the average expenditure on food was higher for subsistence-oriented households than for commercially oriented households (Tables 2 and 7). The average expenditure on food reported by the subsistence-oriented households was ETB 699, while it was ETB 595 for the commercially oriented households, which was 15% higher than that of the commercially oriented households. After controlling for other factors using the PSM method, the subsistence-oriented households, on average, expended on food about ETB 113 per person per year more (16% higher) than commercially oriented households. Nevertheless, there has been no strong statistical evidence obtained that supports the hypothesis that more market production has significant effects on consumption expenditures. Neither is there economic significance, as the change is only ETB 113 per year per person. The results suggest that commercialization reduces consumption expenditures.

Table 7. Effects of livestock commercial orientation.

| Outcome Variables                  | Sample     | Treated | Controls | Difference | S.E.  | T-Stat |
|-----------------------------------|------------|---------|----------|------------|-------|--------|
| Prevalence of HHFI (HFIAS score)  | Unmatched  | 10.52   | 9.52     | 0.99       | 0.67  | 1.48   |
|                                    | ATT        | 10.39   | 10.81    | -0.41      | 0.86  | -1.87 *|
| Coping strategy index (rCSI)      | Unmatched  | 12.78   | 12.76    | 0.02       | 0.48  | 0.05   |
|                                    | ATT        | 12.63   | 13.54    | -0.91      | 0.64  | -1.82 *|
| Per capita consumption expenditure| Unmatched  | 595     | 699      | -104       | 65.24 | -1.59  |
|                                    | ATT        | 598     | 711      | -113       | 80.74 | -1.41  |

Source: Computations from survey data, 2019; * p < 0.1.
5. Discussions and Conclusions

5.1. Discussions

Our analysis demonstrates that the participation in livestock marketing practices, measured in degrees of commercial orientation, has the effect of improving food security consistently in the measures of the household food insecurity access scale and the (reduced) coping strategy index. The results of both measures indicate that households engaged in market-oriented livestock production are more likely to experience low food insecurity indices. This means that commercial orientation improves food security to a considerable degree. On the basis of this, the results confirm that the postulated hypothesis of a positive effect of livestock commercial orientation on household food security among Aramis-Adaar pastoralists and Asale agropastoralists held, although it does not with respect to the per capita consumption expenditures. The results suggest that households engaged in more market-oriented livestock production are more likely to experience low levels of food insecurity, as is evident from the low indices of the HFIAS and the rCSI. In this sense, increased market participation serves as a mechanism to support food security by enhancing the purchasing power of (agro) pastoralists. Thus, market production positively affects household food security, as it generates income that empowers the household to purchase a variety of foods it does not produce. Given the increased livestock sales volumes and, thereby the incomes (Table 2), the significantly lower food insecurity levels and coping strategy indices during food shortages among the more commercially oriented households is thus expected. In this regard, scholars assert that improvements in livestock marketing and better functioning markets are needed for the very reason of mitigating food insecurity [103]. Similar studies elsewhere corroborate our findings that the market improves the quality of life of pastoralists through the increase in incomes [65,104]. Galaty [105], in the same stance, points out that by improving and promoting livestock marketing, it would be possible to mitigate food insecurity. In light of this side of the argument, again, other studies underscore that a strategy for addressing the underlying sources of pastoralist vulnerability should include, among other things, support for livestock marketing [6,34]. Moritz [106] also argues that the future for pastoralism and a viable pastoralism will continue to exist, as long as markets function effectively and local incomes are sufficient to purchase foods. Other proponents [62] also add that, with the poverty among pastoralists and the future viability of pastoralism, livestock marketing is a way to decrease poverty and establish economic relationships. Yet, our results indicate that market production is discouraged among (agro) pastoralists, and is held back by, among other things, the pastoralist tradition. Consistent with our results, other studies have also found that cultural orientations evidently stand at odds with market orientations [90]. Pastoralists often prefer to adopt accumulation strategies as a means of reducing the exposure to the risks associated with herd loss due to unwavering risk factors, such as drought, rather than trading for cash [107]. This serves as a traditional insurance risk-coping strategy to overcome natural or man-made vagaries [108]. Therefore, provided that markets are functional, it is evident from the findings that the increased sales incomes for the more commercially oriented families would help them access nonpastoral food grains (through food purchases), so as to complement their consumption and thereby allow them to achieve diversified diets and secured food needs.

Secondly, contrary to the results of the HFIAS and rCSI measures, the results failed to find significant positive results for effects on the per capita consumption expenditures. The results suggest that more commercially oriented households spent less on food purchases than their less commercially oriented (subsistence) counterparts. It appears that the livestock sales volumes and, hence, the sales incomes for subsistence households are far less (Table 2), but the result does not statistically support the premise that more commercially oriented groups tend to spend the increased sales income exclusively on food, thereby leading to improved food security. This could be justified by the fact that these groups of households may spend a relatively reduced proportion of income not only on other foods, but also on nonfood consumption investments called for by commercial
behavior, such as health, the education of children, stimulants (e.g., khat—an aromatic plant), or savings. A prior qualitative study on the same group of pastoralists corroborates the justification that the pastoralists in the study area have developed a new behavior of extravagance in consuming a stimulant (khat), which pushes them to aggressively engage in livestock selling (Benti et al., forthcoming). Men and young boys, who often take authority for selling livestock in towns distant from villages, may also be attracted by town life, where they spend a greater portion of their sales incomes on nonfood items and entertainment services (e.g., alcohol or khat). As a result, they could end up with smaller remains for food grain purchases for their family to support consumption. Another study on Ethiopian pastoralists found that the expenditures of their sales incomes on nonfood consumption, such as alcohol or khat, which could occur as an expense of the pastoralist tradition, is also evident [90]. Long before, von Braun [45], in his seminal work on agricultural commercialization, suspected that if the sales returns are controlled by the male heads of households, and if the propensities to consume are inclined toward nonfoods, the food security effects of commercialization may not be observed, or commercialization may even impact food security adversely. Therefore, income generated by livestock sales for the more commercially oriented groups might be invested in things other than diet diversification or increasing the quantity and quality of foods. However, the measure does not indicate what percent of the income is spent on food. This does not mean that the increased sales income is used to supplement consumption, and that it is, thereby, an effect of improved food security. Conversely for subsistence groups, it may appear that all, or a greater portion of sales income may be devoted to food purchases, yet may fall short of achieving secured food needs for families, as the total sales volume (income) is less. Nevertheless, this result is inconsistent with other studies, which found that market-oriented households are better able to purchase different types of foods through increased incomes and, thus, have more diverse diets and more secured consumption [69]. Thus, given that the ‘per capita consumption expenditure’ is limited neither by informing what proportion of the sales income was spent on food purchases, nor by whether the money was spent on high-calorie foods and other non-livestock activities (which might reduce the proportion of money spent on food), it can still be concluded that market production at least partly plays a role in improving food security, if not by all the measures used in this study. Hence, further studies on what proportion of the sales income is devoted to food purchases, and on what kinds of foods in particular, are needed for a better conclusion and more informed policy decisions.

Third, it also appears from the findings that the inaccessibility to markets, and livestock deaths and livestock slaughters for ritual purposes, discourage market production, while the access to production services (e.g., credit access) and livestock mobility significantly and positively contribute towards market production. Thus, the findings imply that pastoralist production is under major marketing limitations, where the market production is affected by a broad range of factors, identified in this study as infrastructure, culture, and production risks. These, in turn, limit the overall improvement in food security. It is also evident from similar studies elsewhere that the pastoral economy, in general, is largely hindered by significant market imperfections [109]. It faces high transaction costs, poor market infrastructures, and weak backward and forward linkages and interactions [41,42]. From the same stance, Tessema et al. [90] found that market-discouraging norms stand at odds with market orientations. Hence, the low levels of participation in markets by pastoralists is mainly due to the depressing factors of market production, as also indicated in Negassa et al. [110]. Thus, the sector’s low market orientation is, by and large, attributable to a range of factors that put pressure on welfare outcomes, such as food security, which is at its lowest levels in these areas. Consequently, the increased opportunities offered, and the new markets opened to pastoralists by the rapid growth of demand [111,112] remain rare, and limit the improvements in livelihoods. A lack of integration into the market compels households with low access to the market to allocate less resources and effort to risk-management strategies, putting them in the poverty trap. Therefore, better
welfare outcomes call for strategic action that deals with the depressing factors of market production, thereby paving the way for integration into the market economy.

5.2. Conclusions

In conclusion, it is evident from the key findings that, whereas sufficiently integrating pastoralists into the market could be an important mechanism to overcoming the multifarious problems constraining pastoralism, livestock marketing practices are falling short in terms of sufficient and sustainably supported pastoralism, mainly because of the constraining factors in market production. Therefore, the commercial orientation of pastoralists is not sufficient to sustainably improve livelihoods, and it is important that market production constraints are addressed. Thus, what is needed is a mixed approach, which combines policies targeted at market production, production risk management, and market infrastructure development, that are consistent with the pastoralist tradition. This calls for a need for policy investments towards pastoral cultural sensitivity in promoting a pastoral market orientation to sustainably improve livelihoods and achieve the desired welfare outcomes. Thus, this study applauds culturally sensitive pastoral market-based policy initiatives for sustainably improving livelihoods. It is vital that the government invest in rural market infrastructure in order to promote the pastoral economy’s integration into markets. This could be achieved by establishing (mobile) markets with the needed facilities at strategic locations, such as along moving routes and in temporary settlement camps (guro terminus). Moreover, interventions aimed at strengthening traditional institutions for interclan conflict resolution and market information exchange (e.g., dague for market information, involving clan leaders and elders in interclan conflict resolution), facilitating pastoral groups (e.g., clanship to bargain in the market), and improving access to services (e.g., access to credit) could serve a central role in stimulating pastoralist market production and reducing welfare levels. Thus, the local and federal governments do have critical roles to play in improving the market infrastructure and minimizing the incidences of interclan conflict for the enhanced market integration of pastoralists. Furthermore, future studies in the area of pastoralist livestock commercialization towards higher welfare levels need to pay attention to the cultural and social dimensions of the commercialization of the pastoral economy.

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Conflicts of Interest: The authors declare no conflict of interest.
Appendix A

Table A1. Confusion Matrix: Logistic Model for Commercialization Degree.

| Classified | True    | Total |
|------------|---------|-------|
| +          | 22      | 33    |
| −          | 42      | 286   |

Classified + if predicted Pr (D) ≥ 0.5. True D defined as commercialization degree, ! = 0.

- Sensitivity Pr (+| D) 34.38%
- Specificity Pr (−|~D) 95.69%
- Positive predictive value Pr (D| +) 66.67%
- Negative predictive value Pr (~D| −) 85.31%
- False + rate for true ~D Pr (+|~D) 4.31%
- False − rate for true D Pr (−| D) 65.63%
- False + rate for classified+ Pr (+| D) 33.33%
- False − rate for classified− Pr (−| D) 14.69%

Correctly classified 83%

Source: Computations from survey data, 2019.

Inspecting the confusion matrix, the overall rate of correct classification (overall predicted accuracy) is estimated to be 82.45, with 95.69% of the ‘subsistence’ group correctly classified (specificity), and only 34.38% of the ‘commercial’ group correctly classified (sensitivity). Thus, the phenomenon that classification is sensitive to the relative sizes of each component group, and always favors classification into the larger group, is evident.

References
1. Smith, J.L.D.; Sones, K.; Grace, D.; Macmillan, S.; Tarawali, S.; Herrero, M. Beyond milk, meat, and eggs: Role of livestock in food and nutrition security. *Anim. Front.* 2013, 3, 6–13. [CrossRef]
2. Ikeya, K.; Fratkin, E. Introduction: Pastoralists and Their Neighbors: Perspectives from Asia and Africa. *Senri Ethnol. Stud.* 2005, sol, 1–14.
3. Devereux, S. Better Marginalised than Incorporated? Pastoralist Livelihoods in Somali Region, Ethiopia. *Eur. J. Dev. Res.* 2010, 22, 678–695. [CrossRef]
4. Davies, J. Capitalization, Commoditization and Obligation Among Ethiopia’s Afar Pastoralists. *Nomadic Peoples* 2006, 10, 29–52. [CrossRef]
5. Little, P.D.; Debsu, D.N.; Tiki, W. How pastoralists perceive and respond to market opportunities: The case of the Horn of Africa. *Food Policy* 2014, 49, 389–397. [CrossRef]
6. Negatu, W. Economic Interactions of Pastoral Lowland and Highland Systems and Implications for Sustainable Livelihoods: A Case Study in Northeastern Ethiopia; Forum for Social Studies: Addis Ababa, Ethiopia, 2011.
7. Mulder, M.B.; Fazzio, I.; Irons, W.; McElreath, R.L.; Bowles, S.; Bell, A.; Hertz, T.; Hazzah, L. Pastoralism and Wealth Inequality: Revisiting an Old Question. *Curr. Anthropol.* 2010, 51, 35–48. [CrossRef]
8. Greenough, K.M. Small as cash crop, small as Habbanayi: Fulbe exchanges in the Twenty-First Century. *Ethnology* 2010, 49, 129–148.
9. Tek, T.; Azeze, A. Cross-Border Trade and Food Security in the Ethiopia-Djibouti and Ethiopia-Somalia Borderlands; OSSREA Development: Addis Ababa, Ethiopia, 2002.
10. Little, P.D. *Cross-Border Cattle Trade and Food Security in the Kenya/Somalia Borderlands*; Clark University: Worcester, MA, USA, 1996.
11. Akilu, Y.; Catley, A. Mind the Gap: Commercialization, Livelihoods and Wealth Disparity in Pastoralist Areas of Ethiopia. *Int. J. Clin. Pract.* 2011, 65, 375. [CrossRef]
12. Krätli, S.; Huelsebusch, C.; Brooks, S.; Kaufmann, B. Pastoralism: A critical asset for food security under global climate change. *Anim. Front.* 2013, 3, 42–50. [CrossRef]
13. FAO. *World Food Summit: Rome Declaration on World Food Security: 13–17 November 1996. Rome*; FAO: Rome, Italy, 1996.
14. Headey, D.; Taffesse, A.S.; You, L. Diversification and Development in Pastoralist Ethiopia. *World Dev.* 2014, 56, 200–213. [CrossRef]
54. Bekele, A.; Belay, K.; Legesse, B.; Lemma, T. Effects of crop commercial orientation on productivity of smallholder farmers in drought-prone areas of the central rift valley of Ethiopia. J. Rural Dev. 2010, 33, 105–128.

55. Fre, Z.; Tesfagergis, B. Economic contribution of pastoral and agro pastoral production to food security and livelihoods systems in Africa: The case of Eastern Sudan, Eritrea and Western Ethiopia in the Horn of Africa. Ethiop. J. Res. Innov. Foresight 2013, 5, 14–31.

56. Staatz, J.M.; D’Agostino, V.C.; Sundberg, S. Measuring Food Security in Africa: Conceptual, Empirical, and Policy Issues. Am. J. Agric. Econ. 1997, 79, 628–634. [CrossRef]

57. Timmer, C.P. Farmers and Markets: The Political Economy of New Paradigms. Am. J. Agric. Econ. 1997, 79, 621–627. [CrossRef]

58. Barrett, C. Smallholder market participation: Concepts and evidence from eastern and southern Africa. Food Policy 2008, 33, 299–317. [CrossRef]

59. Lu, F. Integration into the Market among Indigenous Peoples A Cross—Cultural Perspective from the Ecuadorian Amazon. Curr. Anthropol. 2007, 48, 593–602. [CrossRef]

60. Rueff, H.; Rahim, I. Enhancing the economic viability of pastoralism: The need to balance interventions. Sci. Tech. Off. Int. Epiz. 2016, 35, 577–586. [CrossRef] [PubMed]

61. Ur-Rahim, I.; Maselli, D.; Rueff, H.; Bonfoh, B. Market Access and Herders’ Strategies to Pass through Lean Winter Periods in Post-soviet Kyrgyzstan. APCEBEE Procedia 2014, 8, 323–328. [CrossRef]

62. McPeak, J. Confronting the risk of asset loss: What role do livestock transfers in northern Kenya play? J. Dev. Econ. 2006, 81, 415–437. [CrossRef]

63. Duttily-Diane, C. Pastoral Economics and Marketing in North Africa: A Literature Review. Nomadic Peoples 2007, 11, 69–90. [CrossRef]

64. Reda, K.T. Social organization and cultural institutions of the Afar of Northern Ethiopia. Int. J. Sociol. Anthropol. 2011, 3, 423–429.

65. Teko, T.; Azeze, A.; Gebremariam, A. Cross-Border Livestock Trade and Food Security in the Southern and Southeastern Ethiopia Borderlands; OSSREA: Addis Ababa, Ethiopia, 1999.

66. Roba, G.M.; Lelea, M.A.; Kaufmann, B. Maneuvering through difficult terrain: How local traders link pastoralists to markets. J. Rural Stud. 2017, 54, 85–97. [CrossRef]

67. Molteo, A.; Troubat, N.; Lokshin, M.; Sajaia, Z. Analyzing Food Security Using Household Survey Data; International Bank for Reconstruction and Development/The World Bank: Washington, DC, USA, 2014.

68. Ruane, J.; Sonnino, A. Agricultural biotechnologies in developing countries and their possible contribution to food security. J. Biotechnol. 2011, 156, 356–363. [CrossRef]

69. Ntakyo, P.R.; Berg, M.V.D. Effect of market production on rural household food consumption: Evidence from Uganda. Food Secur. 2019, 11, 1051–1070. [CrossRef]

70. Devereux, S.; Bauch, B.; Hussein, K.; Shoham, J.; Sida, H.; Wilcock, D. Improving the Analysis of Food Insecurity: Food Insecurity Measurement, Livelihoods Approaches and Policy: Applications in Frauds; FAO: Rome, Italy, 2004; pp. 1–45.

71. Helland, J. Afer Resilience Study; CMI. Work. Pap. WP 2015;6; Chr. Michelsen Institute: Bergen, Norway, 2015; 47p, Available online: http://www.cmi.no/publications/file/5560-afer-resilience-study.pdf (accessed on 4 April 2020).

72. CSA. Population Projections for Ethiopia, 2007–2037; CSA: Addis Ababa, Ethiopia, 2013.

73. MoARD. An Atlas of Ethiopian Livelihoods: The Livelihoods Integration Unit; USAID, Government of Ethiopia: Disaster Risk Management and Food Security Sector, MOARD: Addis Ababa, Ethiopia, 2010.

74. Saunders, M.; Lewis, P.; Thornhill, A. Research Methods for Business Students, 5th ed.; Pearson Education Limited: Edinburgh, UK, 2009.
108. Gebru, G.; Mcpeak, J. *Herd Accumulation: A Pastoral Strategy to Reduce Risk Exposure*; Global Livestock CRSP, University of California- Davis: Davis, CA, USA, 2014.

109. Hoddinott, J.; Headey, D.; Dereje, M. Cows, Missing Milk Markets, and Nutrition in Rural Ethiopia. *J. Dev. Stud.* 2015, 51, 958–975. [CrossRef]

110. Negassa, A.; Rashid, S.; Gebremedhin, B.; Kennedy, A. 6 Livestock Production and Marketing. In *Food and Agriculture in Ethiopia*; University of Pennsylvania Press: Philadelphia, PA, USA, 2014. [CrossRef]

111. Alary, V.; Corniaux, C.; Gautier, D. Livestock’s Contribution to Poverty Alleviation: How to Measure It? *World Dev.* 2011, 39, 1638–1648. [CrossRef]

112. Gautier, D.; Locatelli, B.; Corniaux, C.; Alary, V. Global changes, livestock and vulnerability: The social construction of markets as an adaptive strategy. *Geogr. J.* 2016, 182, 153–164. [CrossRef]