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Gender, Access to Agricultural Resources and Food Security in Kenya

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KIPPRA in Brief

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Abstract

Food insecurity is a major development challenge in developing countries. In Kenya, the food poverty incidence remains high, as about 1 in every 3 individuals does not meet the minimum daily calorific requirement. Research points to possible gender-linked pathways through which agriculture influences food security in households. Gender considerations are especially important in the African context where there are broad divisions in the responsibilities between men and women and how they use their personal income in line with traditional cultures. To evaluate this pathway in the Kenyan context, we explore how women's empowerment in agriculture compares to that of men, and its effects on household's food security outcomes, measured using household's food consumption scores. We find that approximately 28 per cent of households in Kenya are food insecure. We further show that women in agriculture are more disempowered relative to men. Women are mainly disempowered in: access to and decisions on agricultural credit, agricultural group membership, and asset ownership. Men are mainly disempowered in access to and decisions on agricultural credit and agricultural group membership. We find that women's empowerment has a positive and significant effect on households' food consumption scores, whereas the male's empowerment effect is weaker and much lower. The dimensions of women's empowerment that matter most in increasing household's food consumption cost are input in productive decisions, control over use of income, and group membership. With men, the dimension that matters most in increasing household's food consumption cost is access to and decisions on credit. The study results suggest that household food and nutrition security could be enhanced to a greater degree through interventions that promote women's empowerment in agriculture.

Abbreviations and Acronyms

AFC	Agricultural Finance Corporation
AfDB	African Development Bank
ASDP	Agriculture Sector Development Programme
ASDS	Agriculture Sector Development Strategy
ASGTS	Agricultural Sector Growth and Transformation Strategy
ATE	Average Treatment Effect
CAADP	Comprehensive African Agricultural Development Programme
CF	Control function
COVID-19	Coronavirus 2019
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
IFRC	International Federation of Red Cross and Red Crescent Societies
KARI	Kenya Agricultural Research Institute
Kcal	Kilo calories
KIHBS	Kenya Integrated Budget Household Survey
KNBS	Kenya National Bureau of Statistics
MoAL&F	Ministry of Agriculture, Livestock and Fisheries
MTP	Medium-Term Plan
NALEP	National Agriculture and Livestock Extension Programme
POMs	Potential outcome means
SNV EOWE	Netherlands Development Organization (SNV) Enhancing Opportunities for Women's Enterprises (EOWE)
UN	United Nations
UoN	University of Nairobi
WAAW	Women Affirmative Action Window
WEAI	Women's Empowerment in Agriculture Index
WFP	World Food Programme

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1. Introduction

To sustain economic growth and eradicate poverty, food security needs to be central in cross-sectoral strategies at the national, regional and global levels (Torero, 2014). All four pillars of food security: availability, accessibility, utilization, and stability not only carry significant benefits for human health and development (Government of Kenya, 2012; IFRC, 2013; Government of Kenya, 2017) but also serve as the basis to achieve sustained socio-economic growth (Hanson, 2013; Torero, 2014; Republic of Kenya, 2017).

In Kenya, food and nutrition insecurity is closely related to poverty, with the chronically food insecure population also suffering from extreme poverty (Republic of Kenya, 2017). Kenya has put in place the "Big Four" agenda, a developmental guide, focused on basic needs that offer a high quality of life to all its citizens, and promoting a strong inclusive economic growth as the country moves towards becoming an upper middle-income economy by 2030 (Government of Kenya, 2018). Among the "Big Four" initiatives is ensuring that all citizens enjoy food security and improved nutrition by 2022, which is enshrined in the Constitution of Kenya 2010, which stipulates the need for adequate food of acceptable quality and freedom from hunger as a right for all Kenyans.

From the latest report on well-being in Kenya based on the 2015/16 Kenya Integrated Household Budget Survey (KIHBS), the food poverty incidence remains high as about 1 in every 3 individuals does not meet the minimum daily calorific requirement of 2,250 Kcal (KNBS, 2018). In terms of numbers of individuals living in food poverty, as at 2015/16, the country had 14.5 million food poor individuals (KNBS, 2018). The economic impact of the COVID-19 may have worsened the food poverty incidence in the country. Food poverty is higher in rural areas where 35.8 per cent of the population (10,419,000 individuals) in the Kenya Integrated Household Budget Survey 2015/16 were below the food poverty line, much higher compared to 28.9 %per cent (817,000 individuals) in peri-urban areas and 24.4 per cent (3,728,000 individuals) in core-urban areas. Looking at food consumption distribution, nationally, 68.3 per cent of total food consumed is from purchases while 18 per cent is from own production (KNBS, 2018). Similarly, in rural, peri-urban and core-urban areas, households mainly source their food from purchases, accounting for 57.4 per cent, 65.6% per cent and 85.7 per cent of total food consumed, respectively (KNBS, 2018). However, in peri-urban and rural areas, a significant share of food from own production is consumed, accounting for 21.7 per cent and 27.7 % per cent, respectively with 2.4 per cent of households in urban areas consuming food from their own production (KNBS, 2018). From the above, it is observed that increased agricultural production and productivity, and increased agricultural income for increased expenditure on

improved foods/dietary intake are important to attain food and nutrition security in the country (Kadiyala et al., 2014; Pandey et al., 2016; Signorelli et al., 2017; Hirvonen and Hoddinott, 2014; Koppmair et al., 2017; Ecker, 2018; Kihiu and Amuakwa-Mensah, 2020).

Further, consideration of gender - defined as "the social, behavioural, and cultural attributes, expectations, and norms associated with being male or female" (World Bank, 2015) - in development agenda, such as enhanced food security, is especially important in the African context where there are broad divisions in the responsibilities between men and women and how they use their personal income in line with traditional cultures (World Bank et al., 2009; Akresh, 2008; Djebbari, 2005; Ngigi et al., 2017; Njuki et al., 2011; Quisumbing et al., 2015). For instance, in the traditional African culture, issues of food are expected to be deal with by women (Njuki et al., 2011) in settings whereby resources and income can be held and managed separately by women and men within a household (Ngigi et al., 2017; Njuki et al., 2011; Quisumbing et al., 2015). In addition, women play a central role as food producers and managers in household and national food security (Agarwal, 2018). Women are particularly central actors in food provisioning and are crucial in translating agricultural products and income into households' food and nutritional security (World Bank et al., 2009). Women's agricultural activities, which often involve production for subsistence purposes, contribute to small but potential significant household's income (Varangis, 2015). When women have an income, substantial evidence globally indicates that the income is more likely to be spent on households' food and nutritional needs (FAO, 2011; World Bank et al., 2009).

Gender analysis in agrifood systems is thus critical for policies, programmes and projects to design interventions that respond to the needs and priorities of both women and men for the attainment of developmental goals. The realization of gender equity - that is, addressing the gaps between females and males in human endowments, economic opportunity, and voice and agency (World Bank, 2015; UN, 2015; UN Women, 2018) - in the agrifood systems calls for mobilization and allocation of sufficient resources for policies and programmes that contribute to its fulfilment. Absence of specific attention to differences between women and men can result in exclusion of either men or women as participants and/or beneficiaries of planned interventions or change (AfDB, 2001).

1.1   Motivation and Justification

Despite the role women in Africa play in securing food security both at household and national level, women face serious social and opportunity constraints

(Ragasa et al., 2019). For instance, in Kenya, the Women Empowerment Index (WEI) - defined as a multi-dimensional concept combining information from a variety of indicators into one composite index (KNBS, 2020) - indicates that 29 per cent of women are empowered when assessed across five domains (KNBS, 2020). The report further indicates that women in urban areas are nearly twice (40%) as likely to be empowered compared to their counterparts in rural areas (22%) (KNBS, 2020). Focusing on women in agriculture, studies further illustrate the disempowerment of women in agriculture relative to men (Agarwal, 2018; Quisumbing et al., 2014).

Focusing on agriculture, a pilot case study on women in livestock value chains and micro credit programmes in Kenya indicated that a larger proportion of men than women was empowered in the three case studies (Waithanji et al., 2013a and b). For instance, along the dairy value chain, only 26 per cent of women who used dairy groups as a mode of marketing were empowered compared to 70 per cent of men. Of women who used other modes of milk marketing, only 17 per cent were empowered compared to 82 per cent of men. Similarly, in western Kenya, an assessment of women empowerment in agriculture indicated that 65.9 per cent of women sampled were considered disempowered (Diiro et al., 2018). A different study conducted in the ASALs (minus Garissa, Mandera, and Wajir counties) revealed that only 31.7 per cent of the sampled women had achieved adequate empowerment (Malapit et al., 2014). Further, only 36.2 per cent of the women in the survey have achieved gender parity, meaning that only 36.2 per cent of women empowerment score in agriculture met or exceeded that of men in their households (Malapit et al., 2014).

Differences in access and control over productive, human and social resources in agriculture often translate into substantial inefficiencies in production, with significant implications on food security at the household and national level. The effect of gender differences in empowerment in agriculture are further magnified by the fact that, contrary to the unitary household model where income and resources are pooled and allocated according to a joint utility function, control over productive resources is individualized among men and women in majority of households (Udry, 1996; Ngigi et al., 2017; Njuki et al., 2011; Quisumbing et al., 2015). The agricultural production system within households is one whereby resources are hardly pooled nor traded among men and women.

As illustrated in Malapit *e*t al. (2014), there is consistent and credible evidence showing that when the status of women in agriculture is improved, agricultural productivity increases, incomes improve, poverty is reduced, and food and nutrition improves. FAO (2011) indicates that improving women's access to productive resources to a similar level as men could increase yields on their

farms by 20 to 30 per cent. This has the potential of increasing total agricultural output in developing countries by 2.5 to 4.0 per cent, which in turn is likely to reduce the number of hungry people in the world by 12 to 17 per cent (FAO, 2011). Increased agricultural yield among women farmers is likely to raise their incomes and enhance food security among households due to their spending patterns (World Bank et al., 2009). Other than increasing agricultural yield and income, improving women's empowerment in agriculture would generate broader social and economic benefits such as improved women's dietary diversity score, child nutritional status, health outcomes, educational attainment and raised level of human capital in society not only for their families but also for generations to come (Kassie et al., 2020; FAO, 2011; World Bank et al., 2009). Empowering women in agriculture would thus generate significant benefits for households and the country at large.

Knowledge of individuals right to adequate food of acceptable quality does not necessarily lead to food and nutrition security. There is need to empower individuals to act on this right, which necessitates access to and control over material, human and social resources. This study aims to increase understanding of the connections between women's empowerment in agriculture and food security in Kenya. We postulate that enhancing women's empowerment in agriculture could have the potential to enhance food and nutrition security at the household level.

While the relationship between women in agriculture and household food security has been assessed in other developing countries (Sraboni et al., 2014; Alkire et al., 2013), to the best of our knowledge, there is no evidence related to how women empowerment in agriculture translates into food security changes at the household level at the national level in a country. Thus, this study contributes to existing research by increasing understanding of the connections between women's empowerment and households' food security in Kenya. An additional key contribution of this study is that we address potential endogeneity issues between households' food security and women empowerment failure to which might bias the impact of increasing women's empowerment on households' food security (Sraboni et al., 2014; Kassie et al., 2020). Most importantly, the results from this study can help to guide policy action focused on food and nutrition security in the country.

1.2   Objective of the Study

As highlighted above, this study aims at availing evidence to increase understanding of the connections between women's empowerment in agriculture and the country's developmental goal of improving food security at the household level.

The study will evaluate the effect of empowering men and women in agriculture on the households' food security outcomes. The specific objectives of the study are:

i) Assess women's empowerment status in agriculture in Kenya and how it compares to that of men.

ii) Assess what has contributed most to the disempowerment of the disempowered women.

iii) Assess whether the factors that contribute to women's disempowerment are similar to those that contribute to men's disempowerment.

iv) Identify the effects on food security of empowerment of women in agriculture and how this compares to that of men.

1.3   Organization of the Study

The rest of the paper is organized as follows. Section 2 reviews the institutional framework in Kenya on gender, agriculture and food security to conceptualize where we are as a country in promoting gender equality and inclusivity for improved food security. Section 3 provides theoretical and empirical literature on gender (in)equalities in agriculture and food security. Section 4 describes the methodology used in the analysis. Section 5 presents and discusses the regression results. Lastly, section 6 presents the conclusion and draws policy implications from the study.

2.   Gender, Agriculture, and Food Security: Institutional Framework Review of Where we are as a Country

The agricultural sector in the country is supported by various policies, laws and strategies that promote gender equality and inclusivity. For instance, the Agricultural Sector Growth and Transformation Strategy (ASGTS) 2019-2029, which is anchored in the belief that "food security requires a vibrant, commercial and modern agricultural sector that sustainably supports Kenya's economic development" identifies the unique challenges preventing majority of women and other special interest groups from achieving the set targets in agriculture. Women are identified as having fewer productive resources, which limits their ability of joining farmer-based organizations that ease access to more affordable and higher-quality inputs and markets (MoALF&I, 2019). The strategy further identifies that inequalities in agriculture drive gender productivity gaps of up to 20-30 per cent between male- and female-managed agricultural enterprises. Having in mind the challenges facing women and other special interest groups, the ASTGS aims at incorporating tailored opportunities for these groups (MoAL&F, 2019). Identification of specific areas of disempowerment of women in agriculture will contribute towards tailored solutions to women for the achievement of developmental goals such as enhanced food and nutrition security in the country.

The country's Third Medium-Term Plan (MTP III) 2018-2022 has been focused on implementing policies, programmes and projects designed to achieve the "Big Four" agenda (2018-2022) focused on basic needs that offer a high quality of life to all its citizens, and promoting a strong inclusive economic growth as the country moves towards becoming an upper middle-income economy by 2030 (Government of Kenya, 2018). Under the "Big Four" agenda, the government prioritizes policies, programmes and projects that will ensure that all citizens enjoy food security and improved nutrition by 2022 (Government of Kenya, 2018). The projects and programmes outlined under MTP III emphasize the promotion of gender equality and empowerment of women, among other special interest groups, in alignment to Aspiration 6 of Africa's Agenda 2063[1]. Towards this, among the programmes and projects for 2018-2022 in the agriculture and livestock is the "Youth and Women Empowerment in Modern Agriculture Programme". This programme aims at creating sustainable and gainful self-employment for the youth and women through their participatory engagement in agriculture. As highlighted before, there is need for identification of need areas of empowerment for women's effective participation in agriculture, including agribusiness value chains.

The Kenya's National Food and Nutrition Security Policy Implementation Framework 2017-2022 highlights that among the factors influencing food

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1   Aspiration 6: An Africa whose development is people-driven, relying on the potential of African people, especially its women and youth, and caring for children

security include access and control of productive resources and gender dynamics. However, the framework acknowledges that there is unequal access to, control and management of productive resources across gender (Republic of Kenya, 2017). According to the framework, achieving food security in the country will be enhanced with increased women and youth empowerment in agricultural production. Towards this, the framework aims at improving equity in access and control of productive resources, and harness the existing potential of productive resources by all genders and vulnerable groups particularly women and youth. Other than access to and control over productive resources, this study will highlight other areas of women's disempowerment towards achieving food security in the country.

In addition to the highlighted strategies, Table 2.1 provides a brief highlight of existing policies, laws and strategies that promote gender equality and inclusivity in agriculture.

Table 2.1: A highlight of existing policies, laws and strategies that promote gender equality and inclusivity in agriculture

The Agricultural Sector Development Strategy (ASDS) 2010-2020	The strategy highlights the need for an effective gender approach to designing and implementing interventions to promote equality and equity of planned outcomes. The strategy further indicates that the government will develop a gender policy for the agricultural sector to mainstream the needs and concerns of women, men, girls and boys in all sectors, and also promote the use of gender analysis and gender-based budgeting in all community-based development programmes. **Gap:** absence of a gender sector policy to guide gender mainstreaming within the entire agricultural sector.
National Horticulture Policy 2012	To end gender discriminating work conditions in the horticultural industry, the policy document aims at enforcing the appropriate laws and promote the mainstreaming of gender and marginalized persons in management of the horticulture industry in line with the Constitution, the Kenya Vision 2030, and the gender and development policy.
Session Paper No. 2 Of 2008 on National Livestock Policy	The policy highlights that women contribute between 60% and 80% of the labour-force for the various activities within the livestock sub-sector, especially in ASAL areas. To address gender issues in the sector, the policy advocates for an effective gender-sensitive approach in designing and implementing various interventions in livestock development initiatives to enable women and youth access efficient production facilities such as land, technology and market information. The policy further proposes that gender issues be incorporated, as much as possible, in all livestock extension messages through participatory approaches.

Sessional Paper No. 5 of 2013 on the National Dairy Development Policy	The policy highlights the lack of access to productive resources for women and youth and proposes, in collaboration with stakeholders, to incorporate gender issues in dairy development activities by having gender and youth friendly policies, including modern technology.
Sessional Paper No. 8 of 2012 on National Policy for the Sustainable Development of Northern Kenya and other Arid Lands	The policy addresses policy challenges that are of particular concern to Northern Kenya and other arid lands to release the latent potential of the arid and semi-arid lands (ASALs). In regard to gender, policy interventions include: • Ensuring that the interests of pastoralists, particularly pastoralist women, are adequately and appropriately addressed in new land legislation and institutions, in line with the National Land Policy. • Establishing mechanisms to extend affordable finance to smallholder farmers, livestock producers and traders, particularly women. • Promote formal and informal job creation, self-employment and entrepreneurship relevant to the needs of women.
Sessional Paper No. 3 of 2009 on National Land Policy Matrimonial Property Act No. 49 of 2013 Law of Succession Act (Cap 160). Revised Edition 2017 [2015].	To protect the rights of women, Sessional Paper No. 3 of 2009 on National Land Policy proposes the following: • Enact appropriate legislation to ensure effective protection of women's rights to land and related resources. • Repeal existing laws and outlaw regulations, customs and practices that discriminate against women in relation to land. • Enforce existing laws and establish a clear legislative framework to protect the rights of women on issues of inheritance to land and land-based resources. • Make provision for joint spousal registration and documentation of land rights, and for joint spousal consent to land disposals, applicable for all forms of tenure. • Secure inheritance rights of unmarried daughters. • Facilitate public awareness campaigns on the need to write wills to protect dependants. • Carry out public education campaigns to encourage the abandonment of cultural practices that bar women from inheriting family land; and • Ensure proportionate representation of women in institutions dealing with land at all levels. Further, to secure the rights of spouses to matrimonial property, the policy document provides for: • Review of succession, matrimonial property and other related laws to ensure that they conform to the principle of gender equity. • Enact specific legislation governing division of matrimonial property to replace the Married Women's Property Act of 1882 of England. • Protect the rights of widows, widowers and divorcees through the enactment of a law on co-ownership of matrimonial property.

- Establish appropriate legal measures to ensure that men and women are entitled to equal rights to matrimonial property; and
- Establish mechanisms to curb selling and mortgaging of family land without the involvement of spouses.

The above principles are seen to help protect women interests in relation to land ownership and inheritance and also access to financial resources.

In line with the above, to secure the rights of spouses to matrimonial property, the Matrimonial Property Act No. 49 of 2013 provides clarity on the term "contribution" for purposes of interpreting the law.

- The Act also indicates that "a married woman has the same rights as a married man — (a) to acquire, administer, hold, control, use and dispose of property whether movable or immovable; (b) to enter into a contract; and (c) to sue and be sued in her own name".
- The Act also regards ownership of matrimonial property as vested in the spouses according to the contribution of either spouse towards its acquisition and also acquisition of interest by contribution towards the improvement of the property.
- In addition, the Act protects spouses from being alienated in any form, whether by way of sale, gift, lease, mortgage or otherwise, from matrimonial property without their consent.
- Last, the Act indicates that the man and wife (wives) have an interest in matrimonial property capable of protection by caveat, caution or otherwise under any law for the time being in force relating to the registration of title to land or of deeds.

The provisions help protect women interests in relation to land and other property ownership and also access to financial resources.

There, however, are areas that still require action to enhance gender equity in the country. For instance, on intestacy, the Law of Succession Act (Cap 160), Revised Edition 2017 [2015] provides that for: agricultural land and crops thereon; or livestock, the law applicable on succession shall be the law or custom applicable to the deceased's community or tribe, as the case may be in various districts set out in the Schedule: West Pokot Wajir, Samburu, Lamu, Turkana, Garissa, Isiolo, Kajiado, Marsabit, Tana River, Mandera and Narok.

Gap: The culture and traditions in the indicated areas/counties continue to support male inheritance of family land/assets and customary practices that discriminate against women in relation to land ownership and inheritance.

Source: Author's compilation

Other than polices and laws, the Government has put in place several initiatives to promote women empowerment in agriculture. The National Agriculture and Livestock Extension Programme (NALEP) developed a guide in 2010 for mainstreaming gender in the agricultural sector in Kenya. The guide aims at assisting policy makers, technical teams and local organizations to recognize and address gender concerns in all their operations. It also helps in standardizing gender approaches, making it possible to compare results between and within organizations. Among the issues highlighted include gender mainstreaming frameworks and gender-sensitive monitoring and evaluation. In addition, the Agricultural Finance Corporation (AFC) acknowledges that despite the crucial role women play in the agricultural sector, they have unequal access to agricultural assets. To enable women, who do not have assets such as land title deeds, to access loans from banking institutions and acquire technology in advancing their farming, AFC launched a Ksh 1 billion unsecured loan scheme for women. This Women Affirmative Action Window (WAAW) will enable women own and control productive assets and promote women entrepreneurship in agriculture. The above initiative is viewed to help the country ensure that at least 30 per cent of agricultural financing is accessed by women, among others, as stipulated in Agenda 2063 call to action for African states.

The path to policy implementation and budget support at the National and County government levels in empowering women in agriculture as envisioned in the highlighted strategies for achievement of developmental goals, such as improved food security, requires evidence on the postulated linkages. As such, this study seeks to contribute towards availing evidence of the connection between women's empowerment in agriculture and enhanced food security at the household level.

3. Theoretical and Empirical Literature

3.1 Empirical Literature: Gender (In)Equalities in Agriculture and Food Security

Gender-based inequalities in agriculture impede the attainment of food security at the individual, household, national, regional, and global levels (World Bank et al., 2009). Asymmetries in ownership, access to and control over resources such as land, water, income, credit, knowledge, technologies and labour negatively affect yield and food security outcomes (World Bank et al., 2009). Generally, men in Africa are advantaged in owning agricultural resources due to social and cultural norms and gender biases (Quisumbing et al., 2014; Johnson et al., 2016; Agarwal, 2018). For instance, studies across Africa indicate that, on average, women are disadvantaged in nearly all measures of landownership and rights to land relative to men (World Bank et al., 2009; Doss et al., 2015; Quisumbing et al., 2014). Women also have poor access to credit, inputs such as fertilizers, irrigation, agricultural extension services, improved technologies, marketing infrastructure and information on new agricultural practices (Agarwal, 2018; World Bank et al., 2009). Asymmetries in agricultural capacity development are also observed. Women are often not targeted, with the assumption that the men in the households will share the knowledge with them (World Bank et al., 2009).

Empirical research confirms pareto inefficiencies in allocation of resources across agricultural production activities of men and women in households. In Burkina Faso, Udry (1996) found strong evidence against a unitary household model: land is not located in the household as a unit but is rather individualized, and that there is pareto-efficiency in intra-household allocations (land controlled by women is farmed less intensively than similar land controlled by men in the same household). The pareto inefficiencies result to approximately 6 per cent losses in output.

To explain the pareto inefficient allocation of productive resources within African households, Akresh (2008) finds that inefficient allocations are less likely to occur where costs caused by such inefficiencies are high. In rainfed agricultural systems, households are observed to be less likely to exhibit Pareto inefficiency in years when there is an exogenous negative rainfall shock. In such periods, the costs of inefficiencies would be high and even greater in poorest households; a luxury that they cannot afford. This implies that losses (costs) caused by gender inequalities are likely to lead to households being less likely to exhibit pareto inefficiency.

Other than reduced yields as illustrated by Udry (1996), additional costs of inequalities in agriculture include negative impacts on food security. Hoddinott and Haddad (1995) find that women spend significantly more on food when a

higher proportion of household income accrues to them compared to men. In addition, men are found to require a US\$ 110 increase in income to achieve the same improvements in children's nutrition and health as women would with a US\$ 10 increase in incomes. The inequalities in agricultural resources are not only costly to food security but also to national economic growth (World Bank et al., 2009).

To further illustrate gender issues in food security, Kassie et al. (2014) examines the link between gender of a household head and food security in rural Kenya. Female-headed households are observed to be more likely to be food-insecure than male-headed households, where the gap is explained by factors such as land quality, farm size, social capital network (including membership of farmers' groups) and distance to the market. Tibesigwa and Visser (2016), in assessing the role of gender of the head of household on food security in South Africa acknowledge that female-headed households depend more on agriculture to increase household food levels compared to male-headed households. This indicates that agriculture remains critical in reducing gender inequalities in household food security (Byerlee et al., 2009). An assessment of eight agricultural development projects in Africa and South Asia also highlights positive impacts of women's use, ownership or control of some types of agricultural assets at both the household and individual levels (Johnson et al., 2016). For instance, having a woman's name on the title is significantly related with her increased participation in agricultural land use decisions, selling produce from a plot, household food purchase and consumption decisions. Empowerment of women in use, control and ownership of agricultural assets is also significantly associated with achieving household nutritional objectives. Similar findings are obtained by Cooper (2018) in Ghana, Zambia, and Bangladesh where supporting women's empowerment in agriculture across various domains mitigates the effects of extreme rainfall on food security as has Sraboni and Quisumbing (2018) on positive effects of women's empowerment on dietary quality of individuals within the household. Empowerment in other aspects such as women's access to credit is also likely to improve the nutritional status of individuals in a family as observed in Malawi (2008).

Conceptualization of gendered perceptions to power is important to understand likely challenges for policy, practice and research in reducing gender inequalities in agriculture. Aberman et al. (2018) show that there exists a predominant zero-sum conception of power among rural communities in Kenya where power is viewed as power over others. The study provides insights on the value of taking a whole-family approach to empowerment to avoid patriarchal resistance of development approaches aimed at empowering women. In a synthesis of global

literature, Okali (2011) also examines obstacles and challenges to transformative change of women in agriculture that is essential to their empowerment. To achieve sustainable transformative change for women, Okali (2011) observes the need for development initiatives to move from the static approach that privileges individuals', in this case women, highlighting the nature of their disadvantage to a relational and well-being oriented one that includes men.

The above studies highlight the importance of addressing gender inequalities across various domains in the agricultural sector to achieve food and nutritional security. In our analysis, we aim at showing that increased empowerment of women in agriculture is an input into a virtuous circle for the benefit of food security outcomes of a household as a whole. This builds on previous studies (Sraboni and Quisumbing, 2018; Cooper, 2018; Akter et al., 2017; Malapit and Quisumbing, 2015; Sraboni et al., 2014) measuring the empowerment, agency and inclusion of women in the agricultural sector, and in turn, the effect on household food security outcomes.

3.2 Theoretical Framework: The Capability Approach and the Theory of the Household

To conceptualize the relationship between gender equality, agriculture and food security, we build on the capability theory by Sen (1993) and the model of household behaviour developed by Udry (1996).

The capability approach is concerned with evaluating an individual in terms of his or her actual ability to achieve various valuable functionings as part of living; what an individual is actually able to do and to be (Sen, 1993; Nussbaum, 2003; Kihiu, 2016). According to the theory, a reduction in inequalities between men and women in society can be achieved by emphasizing on the importance of what people are actually able to do and to be (Nussbaum, 2003). Enhancing an individual's ability to convert resources into an actual functioning, such as the ability to avoid hunger, provides a fruitful and ethical way of reducing gender inequalities, and thus enhancing gender justice. According to Sen, this is better than focusing on equality of incomes or resources as this does not consider that different individuals would require different levels of resources or incomes to have a particular outcome (Day et al., 2016; Nussbaum, 2003). This would be for or various reasons such as: personal differences, different social conditions, exposure to different environment diversities among others hence the importance of focusing on human capabilities to achieve valuable functionings (Day et al., 2016).

Inequalities between women and men in agriculture are especially important with empirical observations that households do not behave as a unitary unit (Udry, et al., 1995; Udry, 1996). This contrasts the assumption of a "unitary household" in the traditional theory of the household and opens door to the distribution of resources within the household (intra-household resource allocation) (Udry, 1996). In his household model, Uldry further shows that allocation of resources across productive enterprises among men and women within households is not Pareto efficient (Udry et al., 1995; Udry, 1996). Pareto efficiency in allocation of productive resources requires that resources are allocated in such a way that it would not be possible to reallocate the resources to make a household individual better off without making another worse off. With the above observations, Uldry advocates for the model advocates recognizing that households do not act "as one" (Udry, 1996). In the African context where men and women have broad divisions in the responsibilities that each satisfy with their resources, such pareto inefficiencies are likely to have negative impacts on various outcomes, such as food insecurity at the household and national level.

In this paper, we argue that given the central role of women in provision of food and primary caregivers of their families, women's empowerment in agriculture is key to food and nutrition security (World Bank et al., 2009; Quisumbing and Pandolfelli, 2010). For the country to secure citizen's right to adequate food, there is need to equally put women and men in a capability to function in this area.

4. Methodology

4.1 Conceptual Framework

Figure 4.1 shows the links between women's empowerment in agriculture and household's food security, which operates through: agricultural production; income;and role of women in agriculture and intra-household decision-making and resource allocation pathways (Ragasa et al., 2019; Kassie et al., 2020; Bhagowalia et al., 2012; Kadiyala et al., 2014; Pandey et al., 2016).

Figure 4.1: Conceptual framework of the links between women's empowerment in agriculture and household's food security
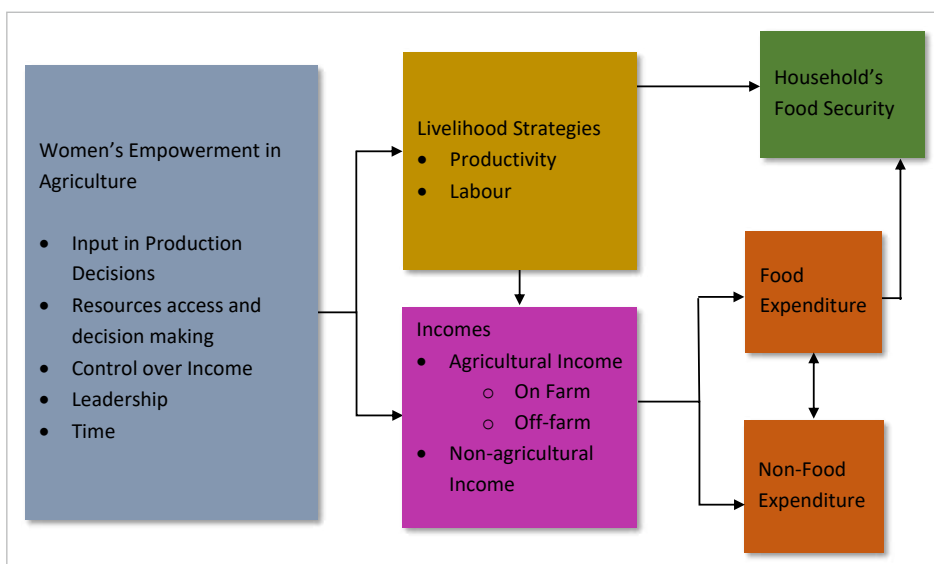
Source: Author's conceptualization

Women's empowerment in agriculture is defined as a composite measure focusing on 5 domains of empowerment, namely: 1. Decision-making power over agricultural production; 2. Access to and decision-making power over productive resources; Control over use of income; 4. Leadership in the community; and 5. Time-use (Malapit et al., 2014; Alkire et al., 2013).

Women's empowerment across the 5 domains plays a role in determining agricultural productive capacity. The ownership, use, and accumulation of physical and human capital play a role in determining productive capacity. In turn, productive capacity affects food security directly when households consume from their own production (Bhagowalia et al., 2012; Kadiyala et al., 2014; Pandey et al., 2016; Ragasa et al., 2019; Kassie et al., 2020). Further, as a key source of rural income, empowerment in agriculture indirectly improves food security

indirectly through the income as a result of increased productivity (Signorelli et al., 2017). Empowerment in agriculture also influences labour allocation (Kassie et al., 2020). Adoption of effective and more efficient ways of production as a result of empowerment is likely to lead to labour-saving where the freed labour could be engaged in off-farm and non-agricultural activities. This has the potential to further increase households' incomes and in turn expenditures on food items.

Of particular interest is the role of women in agriculture and intra-household decision-making and resource allocation. As highlighted earlier, women in majority of the societies play an essential role in selection, acquisition, preparation, and allocation of food among households (Kassie et al., 2020) and are observed to have higher spending on food relative to men within households (Hoddinott and Haddad, 1995; Ragasa et al., 2019). This highlights the crucial importance of empowering women in agriculture, which in turn influences intra-household allocations of food and ultimately household's food security outcomes (Kadiyala et al., 2014; Pandey et al., 2016).

4.2   Analytical Framework

The study uses the Women's Empowerment in Agriculture Index (WEAI) methodology to measure the empowerment, agency, and inclusion of women in the agricultural sector (SNV EOWE, 2019; Alkire et al., 2013; Sraboni et al., 2014; Malapit and Quisumbing, 2015; Akter et al., 2017; Cooper, 2018; Waithanji et al., 2013a and b). The WEAI is a composite comprehensive and standardized measurement tool that directly captures women's empowerment and inclusion levels in the agricultural sector (Malapit et al., 2014). Whereas the WEAI was initially developed to evaluate women's empowerment, it can be used more generally to measure women's and men's empowerment and assess the state of gender parity in agriculture (Alkire et al., 2013). WEAI assesses five domains of empowerment: (i) production; (ii) resources; (iii) income; (iv) leadership; and (v) time (Table 4.1).

Table 4.1: The Women's Empowerment in Agriculture Index (WEAI)

Domain	Indicator	Definition of Indicator	Weight	
Production	Input in productive decisions	Sole or joint input into making decisions about: food crop farming, cash crop farming, livestock raising, and fish culture	1/5	1/10
	Autonomy in production	Autonomy/ability to act on what one values in regard to: agricultural production, which inputs to buy, which types of crops to grow, when to take or who would take crops to the market, and livestock production. It reflects the extent to which an individual's motivation for decision making reflects his/her values rather than a desire to please others or avoid harm.		1/10
Resources	Ownership of assets	Sole or joint ownership of major agricultural assets (including agricultural land, livestock, fishponds, farm machinery and equipment).	1/5	1/15
	Purchase, sale, or transfer of assets	Participates (or can participate) in decisions to buy, sell, or transfer the asset, conditional on the household's owning the asset.		1/15
	Access to and decisions about agricultural credit	Access to and participation in decision making concerning credit.		1/15
Income	Control over use of income	Input into decisions about income generated, conditional on participation in the activity.	1/5	1/5
Leadership in community	Group member	Whether respondent is an active member in at least one economic or social group (e.g., agricultural marketing, credit, water users' groups).	1/5	1/10
	Speaking in public	Whether the person is comfortable speaking up in public (e.g. ease in speaking up in public to help decide on infrastructure such as wells, roads).		1/10
Time	Workload	Allocation of time to productive and domestic tasks. Spent less than or equal to 10.5 hours on paid and unpaid work during the previous day.	1/5	1/10
	Leisure	Satisfaction with the time available for leisure activities.		1/10

Source: Adapted from Alkire et al. (2013) and Sraboni et al. (2014)

In WEAI, the domains and indicators are assigned equal weights because each indicator/domain is equally important for women's empowerment. In addition, there is not enough evidence to support that one is more important than another[2]. Further, analyzing the indicators/domains using the same weights as that given by WEAI enables one to compare their findings to other studies that have used WEAI. Each man/woman is given a binary score (0 or 1) in each of the indicators, reflecting whether he/she has adequate achievements. An empowerment score, summing between 0 and 1, is then generated using the weights of the indicators in which the individual achieves adequacy (Alkire et al., 2013).

A man or woman is defined as empowered if he or she has adequate achievements in four of the five domains or has achieved 'adequacy' in 80 per cent or more of the weighted indicators (Alkire et al., 2013; Sraboni et al., 2014). However, adequacy can be explored over a range of achievements. For example, one might assess of individuals who have achieved adequacy in less than 40 per cent if this is considered to be the most disempowered group (Alkire et al., 2013).

The WEAI has been used widely to analyze the domains that women are empowered in, and how these compare to men's (Waithanji et al., 2013a). Most importantly, WEAI can serve as a diagnostic tool by allowing us to identify areas in which women and men are disempowered, and thus understand how to improve their empowerment levels (Malapit et al., 2014). The WEAI has also been used to explore the linkages between the WEAI and well-being outcomes, such as agricultural growth and food security, for households, women, and children (Kassie et al., 2014; Kadiyala et al., 2014; Pandey et al., 2016; Diiro et al., 2018; Sraboni et al., 2014; Sraboni and Quisumbing, 2018).

4.3   Data

This paper uses the Agricultural Sector Development Support Programme (ASDSP) household baseline survey carried during September-October 2013. The ASDSP was formulated by the government in collaboration with development partners and stakeholders to support the implementation of strategies identified in the Agricultural Sector Development Strategy 2010-2020 (ASDS) and the Comprehensive African Agricultural Development Programme (CAADP) Kenya Compact (Government of Kenya, 2014). The baseline survey was the initial step in implementation of the programme with the aim of generating data and information that will be used to set benchmarks, assess the programme performance and adjust implementation plans. The ASDSP household survey was carried out in all the 47 counties of Kenya by

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2 Whereas IFPRI does not limit one to having equal weights, it cautions that one would no longer able to calculate WEAI. They highly recommend leaving the weights as given to ensure comparability to the WEAI.

the Ministry of Agriculture, Livestock and Fisheries (MoALF) through the ASDSP, in collaboration with the Kenya Agricultural Research Institute (KARI) and the University of Nairobi (UoN). The overall sample size of the household survey was 12,651 agricultural households focusing on resources, climate change and food security. A key strength of the ASDP household survey is that it allows for intra-household analysis, effective for analysing gender differences in empowerment in agriculture in a household. A shortcoming with most recent data is that the agricultural information is reported at the household, not allowing for assessment of differences between men and women in a household.

4.4   Variables

4.4.1   Measurement of outcome variable: Food security

To measure food security, we use the Food Consumption Score (FCS) of the World Food Programme (WFP) (Ecker and van Asselt, 2017; Herforth and Ballard, 2016; WFP, 2015; Jones et al., 2014; WFP, 2009). The FCS represents the dietary diversity, energy and macro and micro (content) value of food people eat (WFP, 2009). The FCS is based on a scale of 9 food groups and the frequency with which they are consumed over a seven-day recall period. The food groups are then assigned weights where greater importance is given to nutritious food (Table 4.2, WFP, 2009).

Table 4. 2: Food consumption score template

	Food group	Weight (A)	Days eaten in past 7 days (B)	Score A x B
Maize, rice, sorghum, millet, bread and other cereals	Cereals tubers, and root crops	2		
Cassava, potatoes, and sweet potatoes				
Beans, peas, groundnuts, and cashew nuts	Pulses	3		
Vegetables, relish, and leaves	Vegetables	1		
Fruits	Fruit	1		
Beef, goat, poultry, pork, eggs, and fish	Meat and fish	4		
Milk, yoghurt, and other dairy	Milk	4		
Sugar and sugar products	Sugar	0.5		
Oils, fats, and butter	Oil	0.5		
Composite score				

Source: Adopted from WFP (2009)

The maximum score a household can achieve is a value of 112. The FCS is then used to categorize households into one of the three food consumption groups (FCGs):

- Poor food consumption: 0 to 21

- Borderline food consumption: 21.5 to 35

- Acceptable food consumption: > 35

WFP (2009), however, indicates that if the overall consumption of oil and sugar in the population is high, the categorization should be as follows:

- Poor food consumption: 0 to 28

- Borderline food consumption: 28.5 to 42

- Acceptable food consumption: > 42

The households can further be categorized as follows:

- Acceptable food consumption households: 'food secure'

- Borderline food consumption households: 'moderately food insecure'

- Poor food consumption households: 'severely food insecure' - (WFP, 2015)

A dummy variable of food secure versus food insecure households is thereafter generated where the moderately and severely food insecure households are grouped together to form the food insecure group:

- Food secure households

- Food insecure households = 'moderately food insecure' + 'severely food insecure'

4.4.2 Measurement of treatment variables: Empowerment indicators

Following Malapit et al. (2017), women's empowerment is estimated using an abbreviated version of the WEAI (the A-WEAI) due to data limitations. The A-WEAI is shorter, more streamlined and still accurately reflects the original index (Malapit et al., 2017). Similar to the WEAI, the A-WEAI focuses on 5 domains of empowerment. However, the domains are assessed over a total of six dichotomous indicators to determine whether a person is empowered as shown in Table 4.3. Among the six indicators retained, the definitions, cutoffs, and aggregation rules remain the same as the WEAI (Malapit et al., 2017).

Table 4.3: The abbreviated version of the WEAI (the A-WEAI)

Domain	Indicator WEAI (10)		Weight	Indicators a-WEAI (6)		Weight
Production	1.	Input in productive decisions	1/10	1.	Input in productive decisions	1/5
	2.	Autonomy in production	1/10			
Resources	3.	Ownership of assets	1/15	2.	Ownership of assets	2/15
	4.	Purchase, sale, or transfer of assets	1/15			
	5.	Access to and decisions about agricultural credit	1/15	3.	Access to and decisions about agricultural credit	1/15
Income	6.	Control over use of income	1/5	4.	Control over use of income	1/5
Leadership in community	7.	Group member	1/10	5.	Group member	1/5
	8.	Speaking in public	1/10			
Time	9.	Workload	1/10	6.	Workload	1/5
	10.	Leisure	1/10			

Source: Malapit et al. (2017)

Further, similar to the WEAI, the A-WEAI ranges from zero to one, with higher values indicating greater empowerment. Individuals are considered as empowered when they have achieved 'adequacy' in 80 per cent or more of the weighted indicators (Malapit et al., 2017; Alkire et al., 2013; Sraboni et al., 2014). But as highlighted earlier, since adequacy can be explored over a range of achievements (Alkire et al., 2013; KNBS, 2020) the study also assess adequacy at the 50 per cent threshold where individuals who have achieved adequacy in 50 per cent or more of the weighted indicators is considered to be empowered. Thus, the study compares incidence of empowerment using 2 different thresholds: 80 and 50 per cent. The A-WEAI has been used to measure women's empowerment in the agricultural sector in various empirical studies in the country (Malapit et al., 2015b; Diiro et al., 2018; SNV EOWE, 2019).

4.4.3   Additional control variables

To better assess the relationship of women and men empowerment on household food security outcomes, the analysis controls for several other household characteristics as shown in Table 4.4

Table 4.4: Selected household characteristics, variable definition and supporting literature

Variable	Description	Mean/Proportion	Std Dev.	Supporting Literature
Household size	Number of people in a household	5.92	2.56	Malapit and Quisumbing, 2015, in Ghana; Malapit et al., 2015a, in Nepal; Sraboni et al., 2014, in Bangladesh; Smith et al., 2003, in South Asia and Sub-Saharan Africa (SSA); Luckett et al., 2015, in Malawi; Signorelli, et al., 2017, in Ghana; Kassie et al., 2014, in Kenya; Tibesigwa, and Visser, 2016, in South Africa
Age of household head	Age (in years) of household head	49.02	14.52	Malapit and Quisumbing, 2015, in Ghana; Malapit et al., 2015a, in Nepal; Sraboni et al. , 2014, in Bangladesh; Luckett et al., 2015, in Malawi; Signorelli, et al., 2017, in Ghana; Sraboni et al., in 2014, in Bangladesh; Tibesigwa, and Visser, 2016, in South Africa
Annual per capita gross wealth	Gross_ wealth (log). Measured by ASDSP as sum of value of all livestock owned, value of household assets and total household income	11.26	1.46	Malapit and Quisumbing, 2015, in Ghana; Malapit et al., 2015a, in Nepal; Signorelli, et al., 2017, in Ghana; Sraboni et al., 2014, in Bangladesh; Kassie et al., 2014, in Kenya; Tibesigwa, and Visser, 2016, in South Africa
Sex of HHead	Sex of the household head: Male=1, Female=0	0.96	0.18	Luckett et al., 2015, in Malawi; Migotto et al., 2006, in Albania, Madagascar, Nepal and Indonesia; Kabunga et al., 2014, in Uganda.
Highest level of education	Highest level of education of household head			
No education	No education (YES=1)	0.18	0.39	Luckett et al., 2015, in Malawi; Malapit et al., 2015a, in Nepal; Sraboni et al., 2014, in Bangladesh; Kassie et al., 2014, in South Africa; Migotto et al., 2006, in Albania, Madagascar, Nepal and Indonesia; Kabunga et al., 2014, in Uganda
Primary	Attained at least Primary Education (YES=1)	0.44	0.50	
Secondary	Attained at least Secondary Education (YES=1)	0.28	0.45	
Tertiary	Attained at least Tertiary(YES=1	0.10	0.31	

Variable	Description			Source
Primary activity	Primary activity of the household head; 0= off-farm, 1=on-farm	0.71	0.45	Sraboni et al., 2014, in Bangladesh; Tibesigwa, and Visser, 2016, in South Africa; Migotto et al., 2006, in Albania, Madagascar, Nepal and Indonesia
Productivity of land	Broad land classification according to its potential3 0 =Medium and High Potential Land, 1= Arid and Semi-arid Land	0.67	0.47	Malapit and Quisumbing, 2015, in Ghana; Malapit et al., 2015a, in Nepal; Luckett et al., 2015, in Malawi; Kassie et al., 2014, in Kenya;
Men_women_education_diff	Education difference between adult male and female (male–female)	1.07	3.43	Kassie et al., 2020, in Kenya; Diiro et al., 2018, in Kenya
Proportion_children_below_10	Proportion of children below 10 years	0.25	0.22	Kassie et al., 2020, in Kenya; Diiro et al., 2018, in Kenya.
Observations		10,062		

Source: Author's calculations using the 2013 ASDSP Household Survey

3   Classification based on: Businge, M.S., Ondimu, K., Maina, I., Mutai, C., Ochola, S.O., Ali, A.A., and Nyangena, W. (2011). Kenya State of the Environment and Outlook 2010. Nairobi: National Environment Management Authority

4.5   **Econometric Approach**

In the analysis, we aim at finding out if empowerment of women in agriculture influences household's food security outcomes. In an ideal world, we would observe the food security outcome when a woman is empowered, and we would observe the food security outcome when the same subject (woman) is not treated. It is important to make both observations under identical conditions so that the only difference measured is the presence or absence of the treatment, being empowered in our case (Wooldridge, 2010). However, it is almost never possible to have the two in observational data. It would be difficult to observe a woman having been empowered (received treatment) and at the same time observations having not being empowered (having not received treatment) (Wooldridge, 2010).

The treatment-effect estimators allow us to estimate the effectiveness of treatments using observational data where treatment status (empowerment of women) is not randomized (Wooldridge, 2010). The estimators enable us to estimate the outcome for that same subject (woman) if they had been exposed to treatment (empowerment); counterfactual outcomes. The average treatment effect is obtained as the average difference of the treatment potential outcomes and the control potential outcomes.

The ATE is obtained as follows:

$$ATE = (Ey_1 - y_0) \tag{4.1}$$

The potential-outcome model specifies that the observed outcome variable y is y_0 when $t = 0$ and that y is y_1 when $t = 1$:

$$y = (1-t)y_0 + ty_1 \tag{4.2}$$

The functional forms for y_0 and y_1 are given as:

$$y_0 = x'\beta_0 + \epsilon_0 \tag{4.3}$$

$$y_1 = x'\beta_1 + \epsilon_1 \tag{4.4}$$

Where β_0 and β_1 are coefficients to be estimated, and ϵ_0 and ϵ_1 are error terms. The treatment variable t_i denotes the treatment received by individual i, where $t = 1$ is the treatment level, and $t = 0$ is the control level. The treatment assignment process is given by:

$$t = \begin{cases} 1 & if\ w'\gamma + \eta > 0 \\ 0 & otherwise \end{cases} \tag{4.5}$$

w is a vector of covariates that affect the treatment assignment, γ is a coefficient vector, and η is an unobservable error term.

To estimate the treatment effects, this study uses the Endogenous treatment effects estimation also adopted in various recent similar studies (Kassie et al., 2020; Diiro et al., 2018). The Endogenous treatment effects estimation is a type of a switching regression model where the outcome equations depend on the regime, in this case the treatment status (Wooldridge, 2002). The estimation model estimates the average treatment effect (ATE) and the potential-outcome means (POMs) from observational data when treatment assignment is correlated with the potential outcomes. It is possible that unobserved endogenous variables influence treatment and the outcome of interest. The endogenous treatment-effects estimation allows one to adjust the model for endogeneity using a control function (CF) approach. The CF approach includes residuals from the treatment assignment model as regressors in the potential outcome model. CF-based estimation first estimates the model of endogenous regressors as a function of instruments, similar to the 'first stage' of 2SLS, then uses the errors from this model as an additional regressor in the main model. By including the errors from the treatment model into the main model, one obtains a new error term that is uncorrelated with the dependent variables, including the endogenous treatment variable. The inclusion of the error term from the treatment model "controls for" the endogeneity by proxying for the unobserved factors that are correlated with the treatment variable (Wooldridge, 2015). The estimation approach uses a linear, a probit, a fractional probit, or an exponential-mean model for the potential outcomes and a probit model for treatment assignment.

The treatment-effects models considered in Endogenous treatment effects estimation are given by:

$$y_{io} = E(y_{io} \mid x_i) + \epsilon_{io} \tag{4.6}$$

$$y_{i1} = E(y_{i1} \mid x_i) + \epsilon_{i1} \tag{4.7}$$

$$t_i = E(t_i \mid z_i) + v_i \tag{4.8}$$

$$y_i = t_i y_{i1} + (1 - t_i) y_{io} \tag{4.9}$$

$$E(\epsilon_{ij} \mid x_i, z_i) = E(\epsilon_{ij} \mid z_i) = E(\epsilon_{ij} \mid x_i) = 0 \text{ for } j \in \{0, 1\} \tag{4.10}$$

$$E(\epsilon_{ij} \mid t) \neq 0 \text{ for } j \in \{0, 1\} \tag{4.11}$$

where the subscript i denotes individual level observations, y_{i1} is the potential outcome of receiving the treatment, y_{io} is the potential outcome when the treatment is not received, t_i is the observed binary treatment, and y_i is the observed outcome.

The potential outcomes are determined by their expected value conditional on a set of regressors x_i and an unobserved random component ϵ_{ij}, for $j \in \{0, 1\}$. The treatment equation too is given by its expectation conditional on a set of regressors z_i, which does not need to differ from x_i, and an unobserved component v_i.

Equation (4.8) is fit using a probit estimator. Unobserved component v_i as the difference between the treatment and the estimate of $E\,(t_i \mid z_i)$ and use this statistic to compute an estimate of $E\,(y_{ij} \mid x_i, v_i, t_i)$ for $j \in \{0, 1\}$. Thus, given our outcome (FCS) is linear, we will have :

$$E\,(y_{ij} \mid x_i, v_i, t_i = x_i'\beta_{1j} + v_i\beta_{2j} \quad for\ j \in \{0, 1\} \tag{4.12}$$

The availability of gender-sensitive data allows the study to carry out estimations that will help evaluate gender differences in empowerment and its effect on households' food security.

The analysis will therefore carry out various estimations to determine the effects of:

i)   Women's aggregate achievement on empowerment (i.e. empowerment score across the six weighted A-WEAI indicators) on households' food security

ii) Men's aggregate achievement on empowerment on households' food security on households' food security

iii) Women's level of empowerment for each individual A-WEAI indicator on households' food security

iv) Men's level of empowerment for each individual A-WEAI indicator on households' food security

5.   Results and Discussion

5.1   Food Security Outcomes

As highlighted earlier, the household food security outcomes are assessed using the Food Consumption Score (FCS), which combines data on dietary diversity and food frequency over a seven-day recall period (Jones et al., 2014). Figure 5.1 presents the consumption frequency of eight food groups among households in Kenya.

Figure 5.1: Consumption frequency of eight food groups among households in Kenya
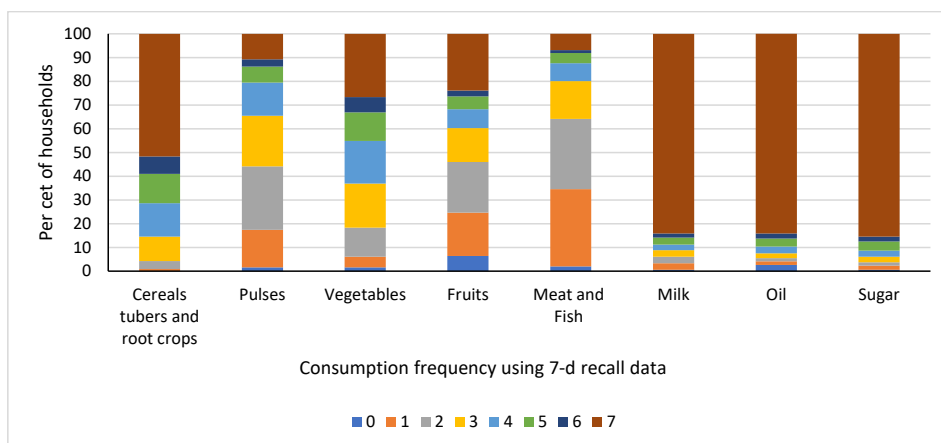
Data Source: Government of Kenya (2014)

NB: Data was collected in 2013 (Between September and October) and published in 2014.

The disaggregated consumption frequency of the various food groups indicates that households have very limited frequency consumption of protein rich foods, fruits, and pulses while consumption of milk, oil and sugar food groups are high.

To obtain the FCS, the consumption frequency of the food groups is assigned weights where greater importance is given to nutritious food (Table 4.2, WFP, 2009). The composite and individual food group scores obtained are presented in Figure 5.2. From the composite score, the mean FCS is about 60, which is above the WFP acceptable score of > 42 (WFP, 2009). However, there are households below the 28 score who are considered as having poor food consumption scores (WFP, 2009).

Figure 5.2: FCS among households in Kenya

Given that the overall consumption of oil and sugar in the population is high (Figure 5.2), households are categorized as follows as per the WFP (2009) guidelines:

- Poor food consumption: 0 to 28
- Borderline food consumption: 28.5 to 42
- Acceptable food consumption: > 42

Households are therefore further categorized as: 'food secure', 'moderately food insecure' and 'severely food insecure'.

Figure 5.3 presents household food security outcomes. Approximately 15.8 per cent of households in Kenya are severely food insecure, 13 per cent are moderately food secure, while 71.2 per cent are food secure. Categorizing the households into food secure and food insecure households shows that about 28.8 per cent of households in Kenya are food insecure. The results mirror the 2015/16 Kenya Integrated Household Budget Survey (KIHBS) results, which indicate the food poverty incidence of households at the national level to be at 23.8 per cent (KNBS, 2018).
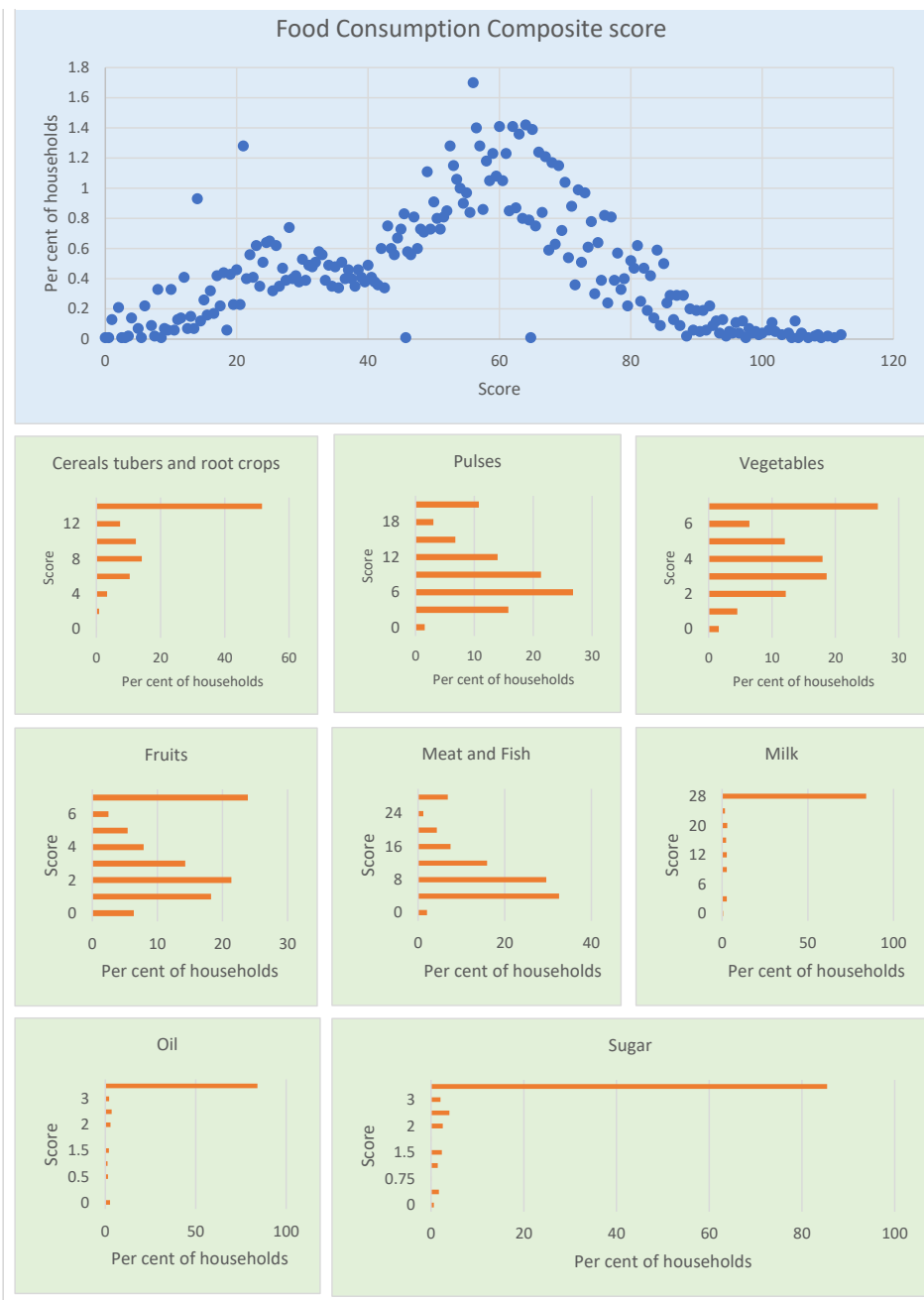
Figure 5.3: Food security outcomes
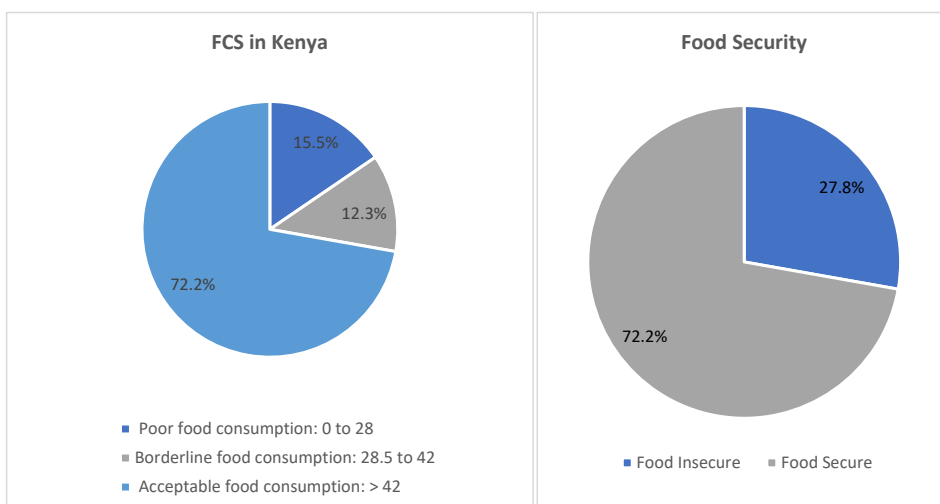
Data Source: Government of Kenya (2014). NB: Data was collected in 2013 (Between September and October) and published in 2014.

5.2   Empowerment Scores

Using the A-WEAI framework, we assess the adequacy scores of women and men in agriculture. Individuals are considered empowered when they have achieved 'adequacy' in 80 per cent or more of the weighted indicators. In addition to the

80 per cent adequacy level, we assess incidence of empowerment at the 50 per cent threshold. Thus, the study compares the incidence of empowerment using 2 different thresholds: 80 and 50 per cent as shown in Figure 5.4. The findings show that 6.12 per cent of women in agriculture are empowered in 80 per cent of the total weighted indicators compared to 16.71 per cent of men. When the threshold of empowerment is lowered to 50 per cent of weighted indicators, 31.47 per cent of women are empowered compared to 67.01 per cent of men at the same threshold.

Figure 5.4: Incidence of women's and men's empowerment in agriculture, national level
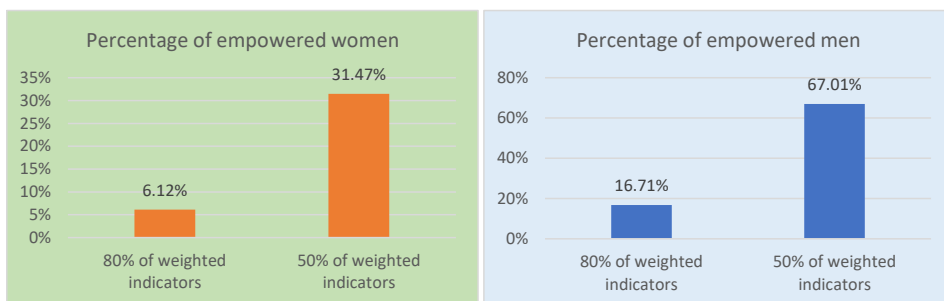
Data Source: Government of Kenya (2014). NB: Data was collected in 2013 (Between September and October) and published in 2014

Disaggregation of empowerment by indicator (Figure 5.5) shows that for all the 6 indicators, men fare better than women. Similar observations were made in Malapit et al. (2014). Women are mainly disempowered in access to and decisions on agricultural credit (84.8%), agricultural group membership (86.2%) and asset ownership (75.6%) and while men are mainly disempowered in access to and decisions on agricultural credit (77.2%) and agricultural group membership (83.3%). The results are similar to some WEAI studies in Kenya access (Malapit et al., 2014; Waithanji et al. 2013a and b), Ownership of assets (Waithanji et al. 2013a and b) and group membership (Diiro et al., 2018).

Figure 5.5: Proportion of women and men identified as empowered, by indicator
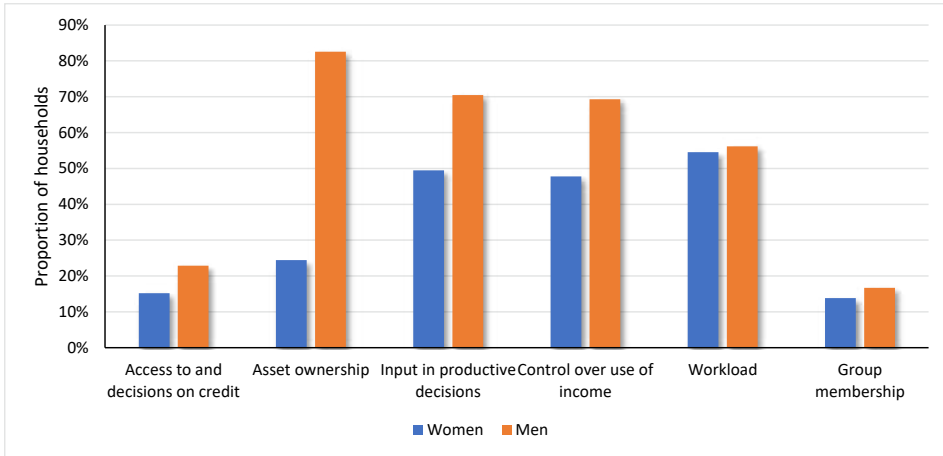
*Group membership measured as membership in agricultural group/association
*Workload measures allocation of time to productive tasks
* Access to and decisions on credit refers to agricultural credit

A key limitation with the workload indicator is that the dataset used, and as is the case with most national surveys, does not measure time allocated to domestic tasks (unpaid work), which is a significant factor influencing time distribution for women especially in developing countries (Malapit et al., 2014; Diiro et al., 2018). The data limitation factor is thus taking to underestimate the disempowerment related to workload, especially among women.

5.2.1 Women's empowerment scores and household food security outcome

Table 5.1 presents the effects of women's aggregate empowerment score on households' food consumption scores, controlling for a set of observable household characteristics. Column 2 presents the potential food consumption score means (potential outcome means, POM) where women in a household are disempowered (Y_o) and where they are empowered (Y_1), respectively. The difference between the two potential outcomes gives the average impact of the empowerment (ATE, column 1). Columns 3 and 4 present the coefficients for the linear equation used to estimate the non-treated POM, and the treated POM, respectively.

The estimates show that female empowerment score is highly significant and positively correlated with household's food consumption score. On average, food consumption score in households where women are empowered is 48.79 points more than households where women are not empowered (Column 1). Similar observations are made in WEAI studies where women's empowerment is observed to have positive significant effects on households' food security outcomes (Sraboni et al., 2014; Cooper, 2018).

In addition to the empowerment variable, the study reveals that household size has a significant negative impact on food consumption scores (Columns 3 and 4). Increasing household sizes means more people to feed, in turn indirectly reducing per capita income, per capita expenditure and per capita food consumption (Signorelli et al., 2017; Tibesigwa and Visser, 2016; Sraboni et al., 2014; Smith et al., 2003). Further, increasing age of household head is found to negatively impact household food consumption scores as observed in similar empirical studies (Signorelli et al., 2017; Sraboni et al., 2014). Wealth has a significant positive effect on food consumption scores, an indication that wealthier households are more likely to be food secure. The finding is similar to that of Sraboni et al. (2014) and Tibesigwa and Visser (2016), who found that wealth may increase household-level calorie availability and dietary diversity through the assets and income channel.

Table 5.1: Impact of women's empowerment on households' food security

Variables	Treated potential outcomes and the control potential outcomes			
	(1)	(2)	(3)	(4)
	ATE	PO mean	Untreated potential-outcome	Treated potential outcome
Empowerment of women in agriculture (1 vs 0)	48.79*** (16.17)			
Potential outcome mean of Y_1 (The mean of Y_1 in the population)		85.99*** (13.54)		
Potential outcome mean of Y_0 (The mean of Y_0 in the population)		37.19*** (5.36)		
Explanatory Variables				
Household size			-0.86*** (0.21)	-0.59*** (0.16)
Sex of the household head (Male=1, Female=0)			24.55** (11.47)	18.54 (16.59)
Age (in years) of household head			-0.18** (0.09)	-0.22*** (0.07)
Gross wealth (log)			2.05 (0.48)	1.90*** (0.39)
Highest level of education of HH Head; Base				
Primary			-3.77 (2.55)	-3.56* (1.91)
Secondary			-3.55 (2.93)	-1.82 (2.28)
Tertiary			-2.03 (2.94)	-1.37 (2.49)
Land (0 =Medium and High Potential Land, 1= Arid and Semi-arid Land)			-2.21 (1.68)	-1.36 (1.45)
Primary activity (0 off-farm, 1 on-farm)			3.97** (1.95)	4.07*** (1.54)
Constant			53.65*** (14.47)	11.70 (16.04)

Consistent with empirical studies on the effects of human capital on food security, lower education levels of the household head in the treated model specification have a negative effect on household food consumption scores (Cooper, 2018; Sraboni et al., 2014; Kassie et al., 2014). Male-headed households have higher food consumption scores in the untreated model specification (column 3). The results confirm existing empirical research that female-headed households on

average are more likely to be food-insecure than male-headed households due to differences in observed productive resource endowments, and also unobservable characteristics/gender differences that reduce their capacity to make use of observable male characteristics (Kassie et al., 2014; Ragasa et al., 2019). On-farm productivity activities are observed to positively impact households' food consumption scores. On farm activities, which involve both productivity and production diversity, are likely to positively impact household's food and nutrition outcomes (Signorelli et al., 2017; Johnson et al., 2016; Pandey et al., 2016). The observations underscore the importance of improving agricultural production and productivity among households for food secure households.

Table 5.2 presents the effects of individual women's empowerment indicators on households' food consumption scores controlling for a set of observable household characteristics. Having disaggregated the composite empowerment indicator, we observe that the dimensions of women's empowerment that matter most in increasing household's food consumption cost are input in productive decisions, control over use of income and group membership.

From Table 5.2 column 1, we observe that the average food consumption score is 55.6 points higher in households where women are empowered in agricultural productive decision-making. The results indicate that increasing women's agency and capability to make decisions in agriculture is likely to not only enable them to engage them more visibly in agriculture but also work towards improving household's food security (Malapit et al., 2015a).

Table 5.2: Indicators for women's empowerment and household food security outcomes

Outcome Variables	Input in productive decisions	Asset ownership	Access to and decisions on credit	Control over use of income	Group membership	Workload
	(1)	(2)	(3)	(4)	(5)	(6)
A) Individual empowerment indicators						
ATE (1 vs 0)	55.60*** (18.04)	62.42* (37.72)	21.68 (19.08)	55.54*** (22.52)	28.26** (13.60)	75.52* (41.82)
B) Untreated potential-outcome equations						
Household size	-0.37** (0.17)	-0.45*** (0.16)	-0.46*** (0.12)	-0.77*** (0.24)	-0.54*** (0.11)	-1.26* (0.70)
Sex of the household head	19.28 (13.64)	26.69 (20.67)	-4.10 (5.20)	11.33 (11.21)	-4.89 (4.11)	-2.75 (9.41)
Age (in years) of household head	-0.23*** (0.09)	-0.01 (0.03)		-0.04 (0.04)		-0.28* (0.16)
Gross wealth (log)	2.95*** (0.35)	2.75*** (0.32)	1.84*** (0.43)	0.27 (1.01)	2.56*** (0.32)	2.94*** (0.50)

C) Highest level of education of HH head						
Primary	-8.06** (4.04)	2.81* (1.71)	-0.82 (1.10)	3.43* (1.94)	0.91 (0.88)	-5.46 (4.32)
Secondary	-5.83 (4.18)	4.68*** (1.63)	1.25 (1.31)	1.96 (2.18)	2.97*** (1.02)	-4.70 (5.09)
Tertiary	-2.65 (3.71)	2.43 (2.03)	-0.42 (2.01)	1.84 (2.77)	3.74*** (1.30)	-2.53 (4.67)
Land (0 =Medium and High Potential Land, 1= Arid and Semiarid Land)	-2.22 (2.27)	4.96*** (2.01)	-0.34 (1.13)	0.33 (1.87)	0.83 (1.09)	-1.20 (2.01)
Primary Activity (0 off-farm, 1 on-farm)	8.51** (3.77)	2.47 (1.79)	0.68 (0.72)	0.16 (1.34)	-0.78 (0.82)	0.14 (1.32)
Constant	-7.07 (17.27)	-22.25 (32.77)	33.96*** (6.16)	1.34 (15.79)	29.88*** (6.03)	7.31 (17.10)
D) Treated potential-outcome equations						
Household size	-0.58*** (0.20)	-0.74*** (0.25)	-0.92*** 0.26	-0.43*** (0.15)	-0.56*** (0.21)	-1.91*** (0.73)
Sex of the household head	18.63** (9.60)	28.98 22.07	11.81*** (4.34)	8.94 (8.55)	10.19*** (2.49)	0.38 (8.50)
Age (in years) of household head	-0.26*** (0.10)	-0.002 (0.04)		-0.003 (0.03)		-0.25 (0.17)
Gross wealth (log)	3.14*** (0.37)	3.66*** (0.46)	2.21*** (0.85)	2.03*** (0.71)	1.80*** (0.58)	3.46*** (0.49)
E) Highest level of education of HH head						
Primary	-11.55*** (4.71)	4.06* (2.16)	4.66* (2.71)	1.43 (1.18)	-0.73 (2.30)	-5.08 (4.58)
Secondary	-9.59** (4.83)	4.93** (2.08)	4.99* (2.98)	1.94 (1.40)	1.62 (2.41)	-3.92 (5.42)
Tertiary	-7.58* (4.19)	2.93 (2.60)	5.98 (3.84)	1.95 (1.71)	0.94 (2.75)	-2.46 (4.91)
Land (0 =Medium and High Potential Land, 1= Arid and Semiarid Land)	-4.92** (2.35)	3.47 (2.50)	-1.77 (2.20)	-1.31 (1.21)	-2.48 (2.19)	-0.24 (1.94)
Primary Activity (0 off-farm, 1 on-farm)	11.34*** (4.19)	3.27 (2.23)	0.63 (1.24)	-0.77 (0.78)	-0.18 1.59	0.67 (1.28)
Constant	52.60*** (12.41)	28.75*** (10.95)	35.23 (29.09)	38.53*** (13.72)	39.47** 19.09	74.78** (34.77)

Women's control over use of income is also associated with higher food consumption scores (column 4). On average, the food consumption score is 55.54 points higher in households where women are empowered in control over use of agricultural income. The results indicate that in dual households, women with greater control over expenditure are more likely to have better food security

outcomes (Malapit et al., 2015a). Similarly, women's group membership has a significant positive effect on household's food consumption score (column 5). We observe that the food consumption score is 28.26 points higher in households where women are active members in agricultural groups. Similar observations are made in Sraboni et al. (2014) and Malapit et al. (2015a) where it was observed that increasing the number of groups in which women actively belong is likely to improve households' food security outcomes.

The other dimensions that matter are asset ownership and workload, though the dimensions are weakly statistically significant (Table 5.2, columns 2 and 3). At the 10% per cent level of significance, women's ownership of productive assets positively impacts households food consumption scores. The analysis shows that the food consumption score is 62.42 points higher in households where women own and have control over major household assets as observed in similar empirical studies (Kassie et al., 2013; Tibesigwa and Visser, 2016; Sraboni et al., 2014). Reduced workload is positively associated with increased food consumption scores of households by 75.52 points (Table 5.2, column 6). A less excessive agricultural productive workforce may influence whether women can reallocate some of their time in engagement in other income generating activities, thus likely to have a positive effect on food security outcomes (Kassie et al., 2020). Further, women have an excessive workload at the expense of their availability of time, which may affect other food security aspects such as nutritional outcomes (Malapit et al., 2015a).

The coefficients for the remaining explanatory variables across the six indicator equations (columns 1 to 6) in the treated and non-treated equations are broadly consistent with the findings in Table 5.

5.2.2 Men's empowerment scores and household food security outcome

Table 5.3 presents the effects of men's aggregate empowerment score on households' food consumption scores, controlling for a set of observable household characteristics. The estimates show that male empowerment, though weakly significant, positively impacts household's food consumption score. On average, the food consumption score in households where a man is empowered is 38.12 points more than in households where men are not empowered (column 1). We further observe that in addition to the male empowerment score being weakly significant but positively correlated with household's food consumption score, the effect is much lower compared to that of women (Table 5.2 column 1). The results

are in support of earlier empirical literature on the role women play in securing food security at the household relative to men (Ragasa et al., 2019; Njuki et al., 2011; Agarwal, 2018; FAO 2011; World Bank et al., 2009).

Table 5.3: Men's empowerment scores and household food security outcomes

Variables	Treated potential outcomes and the control potential Outcomes			
	(1)	(2)	(3)	(4)
	ATE	PO mean	Untreated potential-outcome	Treated potential outcome
Empowerment of men in agriculture (1 vs 0)	38.12* (22.35)			
Potential outcome mean of Y_1 (The mean of Y_1 in the population)		66.60*** (6.07)		
Potential outcome mean of Y_0 (The mean of Y_0 in the population)		28.49 (20.34)		
Instrumental Variables				
Education difference between adult male and female (male−female)				
Proportion of children below 10 years				
Explanatory Variables				
Household size			-0.71** (0.32)	-0.97*** (0.22)
Sex of the household head			-14.76 (11.95)	-21.87** (10.67)
Age (in years) of household head			-0.06 (0.04)	-0.03 (0.03)
Gross wealth (log)			2.31*** (0.60)	1.86*** (0.45)
Highest level of education of HH head; Base				
Primary			-2.59 (3.65)	-4.49 (2.94)
Secondary			-0.96 (4.13)	-2.83 (3.23)
Tertiary			-0.22 (4.61)	-3.01 (3.57)
Land (0 =Medium and High Potential Land, 1= Arid and Semiarid Land)			-2.83 (3.34)	-3.05 (2.57)
Primary Activity (0 off-farm, 1 on-farm)			-6.66 (5.31)	-8.56** (4.24)
Constant			32.24*** (10.27)	85.66*** (28.60)

Similar to the women's scenario, Table 5.4 presents the effects of the individual men's empowerment indicators on households' food consumption scores, controlling for a set of observable household characteristics. The results indicate that, unlike women, the dimension of men's empowerment that matter most in increasing household's food consumption cost is access to and decisions on credit. The coefficient on men's access to and decisions on credit positively impacts household food consumption score (Table 5.4, column 3). On average, the food consumption score in households where a man has access to and decisions on agricultural credit is 30.43 points higher than households where men have no access. Access to credit facilitates access to higher-quality inputs and in turn higher yields and incomes (MoALF&I, 2019). Limited access to affordable agricultural finance has therefore been identified as leading to low agricultural productivity, and in turn low agricultural incomes that are important for increased expenditure on improved foods/dietary intake for attainment of food and nutrition security in the country (Kadiyala et al., 2014; Pandey et al., 2016; Signorelli et al., 2017). Despite its importance , access to and decisions on agricultural credit is very low among the agricultural population in Kenya, including among men, calling for policy action to realize the possible benefits on food and nutrition security (Kihiu *et al.,* 2019).

Further, the coefficients in the treated and non-treated equations indicate that unlike the women's scenarios where on-farm activities were observed as more important for household's food consumption score, in the men scenario, off-farm activities are more important for household's food security outcomes. Similar observations are made in Kassie et al. (2014) where men in the country are observed to have more off-farm income compared to females, and in Tibesigwa and Visser (2016) where off-farm income is observed to be more significant in predicting food security among men compared to women. The rest of the control variables have similar effects as that observed under the women's regressions.

Table 5.4: Indicators for men's empowerment and household food security outcomes

Outcome Variables	Input in productive decisions	Asset ownership	Access to and decisions on credit	Control over use of income	Group membership	Workload
	(1)	(2)	(3)	(4)	(5)	(6)
A) Individual Empowerment Indicators						
ATE (1 vs 0)	21.59 (15.14)	71.51 (43.45)	30.43** (13.32)	31.40 (51.38)	12.57 (9.12)	64.41 (74.24)
B) Untreated Potential-outcome Equations						
Household size	-0.45 (0.32)	-0.77** (0.33)	-0.43*** (0.12)	-0.63*** (0.25)	-0.54*** (0.11)	-0.66 (0.68)

Sex of the household head	-6.08 (7.81)	-29.18 (21.39)	-0.10 (5.22)	-20.23 (26.31)	-4.89 (4.11)	-3.95 (6.76)
Age (in years) of household head	-0.03 (0.04)	-0.21* (0.12)	0.01 (0.02)	0.06 (0.08)		-0.05 (0.08)
Gross wealth (log)	3.23*** (0.38)	2.16*** (0.65)	1.51*** (0.56)	0.70 (2.65)	2.56*** (0.32)	2.54*** (0.33)
C) Highest Level of Education of HH Head						
Primary	-2.22 (4.87)	-1.90 (2.65)	-0.33 (1.02)	6.35 (3.90)	0.91 (0.88)	-0.58 (5.22)
Secondary	1.07 (5.21)	-1.49 (3.39)	0.71 (1.43)	7.77** (3.29)	2.97*** (1.02)	1.26 (5.38)
Tertiary	-0.48 (5.52)	0.08 (4.96)	0.35 (1.83)	10.11** (4.36)	3.74*** (1.30)	2.55 (5.07)
Land (0 =Medium and High Potential Land, 1= Arid and Semiarid Land)	1.18 (2.33)	-5.15 (5.00)	-0.94 (1.56)	1.41 (1.46)	0.83 (1.09)	1.17 (2.11)
Primary Activity (0 off-farm, 1 on-farm)	-3.60 (3.88)	-2.34 (2.17)	-1.87* (0.97)	-10.39 (12.65)	-0.78 (0.82)	0.50 (0.92)
Constant	18.48*** (7.59)	15.97 (14.13)	34.94*** (7.40)	29.91** (13.93)	29.88*** (6.03)	18.51 (24.47)
D) Treated Potential-outcome Equations						
Household size	-1.03*** (0.19)	-0.73*** (0.16)	-0.32 (0.24)	-0.52*** (0.13)	-0.56*** (0.21)	-2.00 (1.31)
Sex of the household head	-13.70 (6.92)	-28.66** (13.63)	-3.06 (5.34)	3.56 (14.64)	10.19*** (2.49)	2.08 (12.32)
Age (in years) of household head	0.02 (0.02)	-0.11** (0.05)	0.06 (0.04)	-0.03 (0.04)		-0.16 (0.16)
Gross wealth (log)	2.78*** (0.24)	2.40*** (0.28)	0.63 (1.22)	3.70*** (1.35)	1.80*** (0.58)	3.21*** (0.60)
E) Highest Level of Education of HH Head						
Primary	-9.01** (3.73)	-0.17 (1.33)	-1.78 (2.54)	-0.49 (2.01)	-0.73 (2.30)	-9.52 (10.32)
Secondary	-7.58** (3.91)	1.49 (1.60)	-1.15 (3.24)	2.04 (1.74)	1.62 (2.41)	-7.38 (10.65)
Tertiary	-6.93 (4.23)	0.61 (2.13)	-0.96 (3.75)	1.83 (2.30)	0.94 (2.75)	-6.45 (10.11)
Land (0 =Medium and High Potential Land, 1= Arid and Semiarid Land)	-2.33 (1.51)	-3.53 (2.58)	-7.89** (3.29)	1.94** (0.90)	-2.48 (2.19)	-2.10 (3.85)
Primary Activity (0 off-farm, 1 on-farm)	-6.87** (2.92)	-1.13 (0.96)	-2.12 (1.95)	5.20 (6.78)	-0.18 (1.59)	0.08 (1.75)
Constant	65.02*** (14.87)	75.85*** (23.55)	81.77*** (29.22)	2.26 (38.99)	39.47*** (19.09)	92.58 (68.97)

6.   Conclusion and Policy Implications

6.1   Conclusion

While the 2010 Kenyan Constitution indicates that every citizen has the right to adequate food of acceptable quality, the right to food can be best thought of as secured only when the relevant capabilities to function in the agriculture sector are present. This paper has explored how women's empowerment in agriculture compares to that of men and its effects on household's food security outcomes; measured using household's food consumption scores.

The results highlight that approximately 27.8 per cent of households in Kenya are food insecure while 72.2 per cent are food secure. In addition, households are observed to have very limited frequency consumption of protein rich foods, fruits, and pulses while consumption of milk, oil and sugar food groups are high.

To assess the level of empowerment among women in a household, we use the Abbreviated Women's Empowerment in Agriculture Index (A-WEAI). The A-WEAI assesses five domains of women's empowerment: (a) production; (ii) resources; (iii) income; (iv) leadership; and (v) time. We compare the incidence of empowerment using 2 different thresholds: 80 per cent and 50 per cent. Women are found to be more disempowered relative to men, where 6.12 per cent of women in agriculture are empowered in 80 per cent of the total weighted indicators compared to 16.71 per cent of men. When the threshold of empowerment is lowered to 50 per cent of weighted indicators, 31.47 per cent of women are found to be empowered compared to 67.01 per cent of men at the same threshold.

Decomposing the A-WEAI into its component indicators, we identify that women are mainly disempowered in access to and decisions on agricultural credit (84.8%), agricultural group membership (86.2%) and asset ownership (75.6%) while men are mainly disempowered in access to and decisions on agricultural credit (77.2%) and agricultural group membership (83.3%).

Further analysis of the effects of women's aggregate empowerment score on households' food consumption scores reveals that, on average, the food consumption score in households where women are empowered is 48.79 points more than households where women are not empowered. A similar assessment of men's empowerment indicates that male empowerment in agriculture, though weakly significant, positively impacts household's food consumption score. On average, the food consumption score in households where a man is empowered is 38.12 points more than households where men are not empowered. In addition to the weak positive significance of men's empowerment on households food security, the effect is much lower compared to that of women. This finding

indicates that the benefits of empowering women in agriculture are not mutually exclusive; rather, they benefit the family as a whole. The findings also support existing empirical literature on the role women play in ensuring food security at the household relative to men.

An assessment of the effects of the individual indicators on food consumption scores indicates that the dimensions of women's empowerment that matter most in increasing household's food consumption cost are input in productive decisions, and control over use of income and group membership. Unlike women, the dimension of men's empowerment that matters most in increasing household's food consumption cost is access to and decisions on credit.

6.2   Policy Implications

The study results highlight important areas of investment within the Agricultural Sector Growth and Transformation Strategy (ASTGS) 2019-2029, which is the overall national policy document for the agricultural sector. The ASTGS 2019-2029 is anchored on: *Anchor 1:* Increase small-scale farmer, pastoralist and fisherfolk incomes; *Anchor 2:* Increase agricultural output and value-add; *Anchor 3:* Boost household food resilience. With millions of Kenyan citizens depending on agriculture for income and food security, empowerment of small-scale farmers is likely to result to improved food security outcomes of households. As acknowledged in the ASTGS 2019-2029, the study finds gender empowerment gaps in agriculture, with women being more disempowered in the sector compared to men. Closing the gender gap in agriculture will not only eliminate the identified gender productivity gaps in the sector but also improve household food security outcomes as derived from the study results.

Therefore, in the ASTGS 2019-2029, the paths that intend to achieve increased food security at the very minimum should address challenges women face in having input into productive decisions, control over use of income and group membership. The study findings call for the ASTGS 2019-2029 to come up with innovative approaches focused at improving women's empowerment in having input in agricultural productive decisions and control over agricultural income for improved good security outcomes as these are determined by how power is conceptualized within communities and households. Further, there is need for the strategy to avail women increased opportunities to join and actively participate in agricultural and social groups to include producer groups, cooperative/societies, marketing groups, processing groups, credit, labour and water users' associations. Social capital among women has been recognized as a key resource not only in improving household's food security outcomes but also in providing important

sources of networks and information and increasing women's access to and control over productive resources.

On the other hand, at the very minimum, strategies towards increasing household food security should address challenges men face, including the male youth, in accessing agricultural finance. This includes expanding the scope of financial products and services, beyond credit, availed to males in agriculture to include adequate financial education, agricultural insurance and savings instruments.

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Appendix

Table A1: First-step probit estimates of the treatment equation for overall women's empowerment and individual indicators of women's empowerment

Outcome variables	Overall Empower-ment	Input in productive decisions	Asset owner-ship	Access to and decisions on credit	Control over use of income	Group member-ship	Workload
	(1)	(2)	(3)	(4)	(5)	(6)	
Instrumental Variables							
Education difference between adult male and female (male–female)	-0.02*** (0.01)	-0.02*** (0.01)	-0.01 (0.01)**	-0.02*** (0.01)	-0.01*** (0.00)	-0.02*** (0.01)	-0.01* (0.005)
Proportion of children below 10 years	-0.0001 (0.09)	-0.001 (0.09)	0.17* (0.09)	-0.15 (0.10)	0.132 (0.08)	-0.15 (0.10)	-0.09 (0.08)
Explanatory Variables							
Household size	0.01 (0.01)	-0.002 (0.01)	-0.01 0.01	-0.0004 (0.01)	0.002 (0.01)	-0.002 (0.01)	0.04*** (0.01)
Sex of the household head	-1.59*** (0.32)	-1.06*** (0.30)	-1.35*** (0.26)	-0.16 (0.27)	-1.00*** (0.31)	0.47 (0.33)	-0.04 (0.24)
Age (in years) of household head	0.01*** (0.001)	0.01*** (0.001)	0.002 (0.001)	0.003* (0.002)	0.002* (0.001)	0.01*** (0.002)	0.01*** (0.001)
Gross wealth (log)	0.04*** (0.01)	-0.02 (0.01)	-0.01 (0.01)	0.11*** (0.01)	0.07*** (0.01)	0.13*** (0.01)	-0.02* (0.01)
Highest level of education of HH Head; Base							
Primary	0.36*** (0.05)	0.59*** (0.05)	-0.06 (0.05)	0.35*** (0.07)	-0.01 (0.05)	0.36*** (0.07)	0.25*** (0.05)
Secondary	0.46*** (0.06)	0.63*** (0.06)	0.00 (0.06)	0.44*** (0.08)	0.15*** (0.06)	0.46*** (0.07)	0.30*** (0.06)
Tertiary	0.46*** (0.08)	0.55*** (0.08)	0.16** (0.08)	0.61*** (0.09)	0.20*** (0.07)	0.52*** (0.09)	0.27*** (0.07)
Land (0 =Medium and High Potential Land, 1= Arid and Semiarid Land)	0.16*** (0.04)	0.22*** (0.04)	-0.17*** (0.04)	0.25*** (0.05)	0.08** (0.04)	0.50*** (0.05)	0.06* (0.04)
Primary Activity (0 off-farm, 1 on-farm)	-0.22*** (0.04)	-0.47*** (0.04)	-0.13*** (0.04)	-0.08* (0.04)	0.02 (0.03)	0.28*** (0.04)	-0.01 (0.03)
Constant	-0.30 (0.35)	0.29 (0.34)	0.85 (0.30)**	-2.61*** (0.33)	-0.06 (0.34)	-4.15*** (0.38)	-0.47 (0.29)

Table A2: First-step probit estimates of the overall men's empowerment and individual indicators of men's empowerment.

Outcome variables	Overall Empower-ment	Input in productive decisions	Asset owner-ship	Access to and decisions on credit	Control over use of income	Group member-ship	Workload
		(1)	(2)	(3)	(4)	(5)	(6)
Instrumental Variables							
Education difference between adult male and female (male–female)	-0.01** (0.01)	-0.02*** (0.01)	-0.01** (0.01)	-0.02*** (0.01)	-0.002 (0.01)	-0.02*** (0.01)	-0.01 (0.005)
Proportion of children below 10 years	-0.15 (0.09)	-0.24*** (0.09)	0.08 (0.11)	-0.07 (0.10)	-0.16* (0.10)	-0.15 (0.10)	0.10 (0.09)
Explanatory Variables							
Household size	0.03*** (0.01)	0.04*** (0.01)	0.01 (0.01)	-0.02** (0.01)	-0.002 (0.01)	-0.002 (0.01)	0.03*** (0.01)
Sex of the household head	1.08*** (0.26)	0.85*** (0.24)	1.25*** (0.24)	-0.09 (0.26)	1.18*** (0.26)	0.47 (0.33)	-0.06 (0.25)
Age (in years) of household head	0.0015 (0.0015)	-0.003** (0.001)	0.01*** (0.002)	-0.004*** (0.002)	-0.005*** (0.001)	0.01*** (0.002)	0.005*** (0.001)
Gross wealth (log)	0.05*** (0.01)	-0.02 (0.01)	0.03** (0.01)	0.19*** (0.01)	0.13*** (0.01)	0.13*** (0.01)	-0.006 (0.01)
Highest level of education of HH Head; Base							
Primary	0.39*** (0.05)	0.76*** (0.05)	0.15*** (0.06)	0.34*** (0.06)	-0.19*** (0.06)	0.36*** (0.07)	0.24*** (0.05)
Secondary	0.45*** (0.06)	0.84*** (0.06)	0.24*** (0.07)	0.52*** (0.07)	-0.15** (0.07)	0.46*** (0.07)	0.26*** (0.06)
Tertiary	0.49*** (0.08)	0.90*** (0.08)	0.36*** (0.09)	0.62*** (0.09)	-0.20*** (0.08)	0.52*** (0.09)	0.25*** (0.07)
Land (0 =Medium and High Potential Land, 1= Arid and Semiarid Land)	0.31*** (0.04)	0.27*** (0.04)	0.38*** (0.05)	0.53*** (0.05)	0.04 (0.04)	0.50*** (0.05)	0.07** (0.04)
Primary Activity (0 off-farm, 1 on-farm)	0.58*** (0.04)	0.64*** (0.04)	0.11*** (0.04)	0.28*** (0.04)	0.64*** (0.04)	0.28*** (0.04)	-0.003 (0.04)
Constant	-2.19*** (0.31)	-1.24*** (0.29)	-1.51*** (0.31)	-3.40 (0.32)	-1.96*** (0.31)	-4.15*** (0.38)	-0.32 (0.29)