

**URBAN AGRICULTURE AND HOUSEHOLD WELFARE: AN
ANALYSIS OF GHANA'S RECENT EXPERIENCE**

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DECLARATION

I, **NAOMI APPIAH**, hereby declare that this thesis is the original research undertaken by myself under the guidance of my supervisors. With the exception of references to other author's work which have been duly cited, this thesis has neither in part nor whole been presented for another degree elsewhere.



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ABSTRACT

In recent times, urban agriculture, which is the practice of growing crops and rearing animals in and around urban centers has gained much prominence especially in developing countries. This may be attributed to the rapid population increase in most urban centers resulting in high unemployment with its attendant negative effects particularly on household welfare. This study provides evidence on the impacts of urban agriculture on household welfare in Ghana. The study also examines the extent as well as the determinants of urban agriculture in Ghana. Data for empirical analysis is obtained from the sixth round of the Ghana Living Standards Survey (GLSS 6) conducted in 2012/2013.

The study employs a logit regression technique to investigate the factors that determine a household's participation in urban agriculture. The analysis reveals that about 30.9 percent of urban households participate in some form of urban agriculture. Characteristics of the household head such as age, gender, education and employment status as well as household characteristics such as household size, ownership of agricultural land and participation in non-farm activities are found to influence participation in urban agriculture.

The propensity score matching (PSM) technique is adopted to analyze the impacts of urban agriculture on household welfare. The analysis reveals that participation in urban agriculture has a positive impact on household welfare. However, though not significant, this positive impact should serve to suggest that the usefulness of urban agriculture cannot be entirely ruled out.

Keywords: Urban agriculture, household welfare, impact, Ghana.

DEDICATION

This study is dedicated to my husband, parents, brothers and all who have contributed to my academic endeavor.



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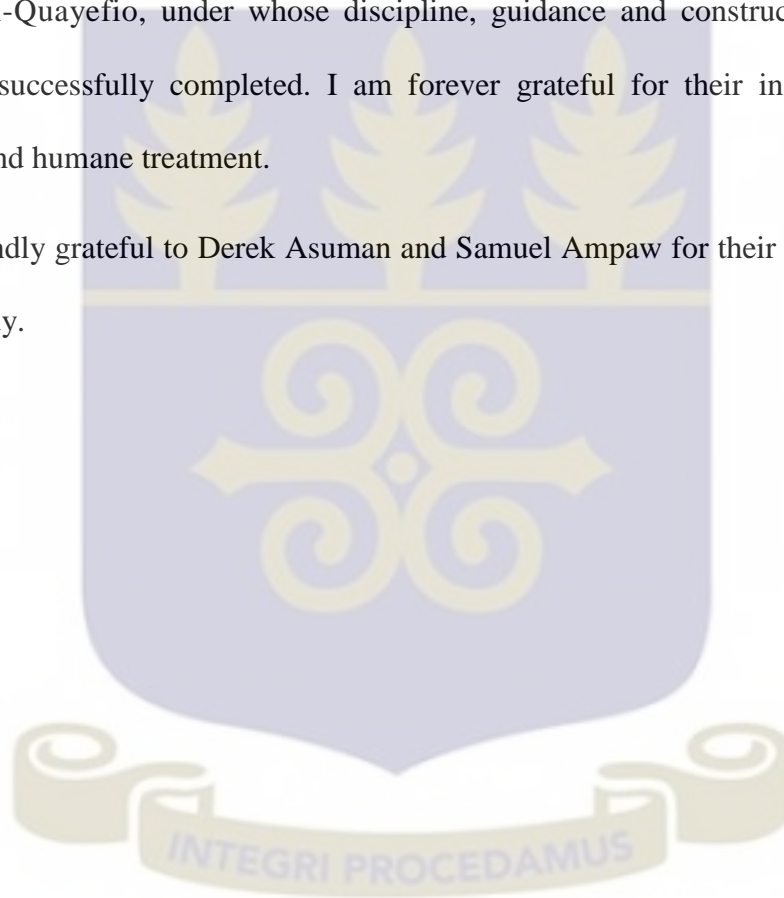


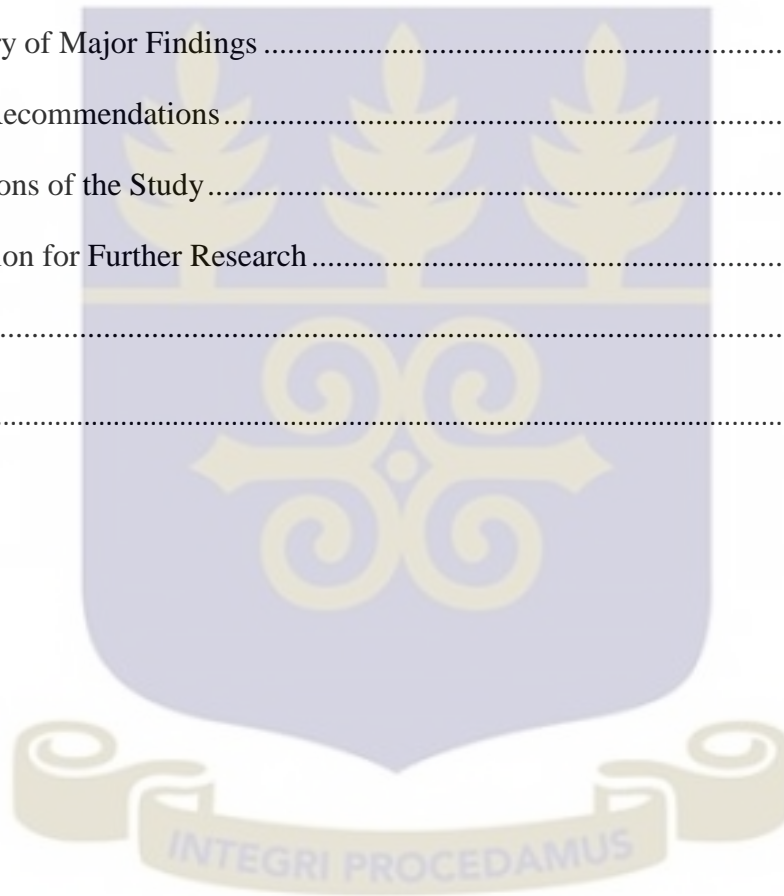
TABLE OF CONTENTS

DECLARATION	i
ABSTRACT.....	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS.....	v
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF ABBREVIATIONS AND ACRONYMS	xi
CHAPTER ONE	1
INTRODUCTION.....	1
1.0 Background to the Study	1
1.1 Research Motivations and Questions	5
1.2 Research Objectives	7
1.3 Justification of the Study.....	8
1.4 Organization of the Study	9
CHAPTER TWO	10
OVERVIEW OF URBAN AGRICULTURE IN GHANA.....	10
2.0 Introduction	10
2.1 Brief Historical Overview of Urban Agriculture in Ghana.....	10

2.2	Forms of Urban Agriculture in Ghana	11
2.3	Importance of Agriculture to Ghana’s Economy	13
2.4	The Potential Role of Urban Agriculture in Ghana.....	14
2.5	The Structure of Urban Households in Ghana	17
2.5.1	Household Size	17
2.6	Characteristics of Urban Household Heads	19
2.7	Distribution of Urban Agriculture in Ghana	22
2.8	Urban Agriculture and Household Welfare	23
2.9	Problems of Urban Farmers in Ghana.....	25
CHAPTER THREE		31
REVIEW OF LITERATURE.....		31
3.0	Introduction	31
3.1	Theoretical Literature	31
3.1.1	Urban Agriculture at the Household Level.....	31
3.2	Empirical Literature	33
3.2.1	The Concept of Urban Agriculture	34
3.3	Determinants of Household Urban Agriculture Participation Decision	38
3.4	Urban Agriculture Production Systems.....	43
3.5	Key Participants of Urban Agriculture.....	45
3.6	Urban Agriculture and Income.....	47
3.7	Urban Agriculture and Employment.....	49
3.8	Urban Agriculture and Food Security	50
3.9	Relevant Literature on Ghana	56

3.10	Summary	59
CHAPTER FOUR.....		60
METHODOLOGY AND DATA		60
4.0	Introduction	60
4.1	Definition of Urban Agriculture.....	60
4.2	Theoretical Conceptualization of Urban Agriculture.....	62
4.3	Estimation Specification and Procedure	63
4.3.1	Modelling Factors Influencing Urban Household’s Participation in Agriculture ..	63
4.4	Description of Variables.....	65
4.4.1	Dependent Variables	65
4.4.2	Independent Variables	66
4.5	Estimation Technique for the Impact Analysis	69
4.6	Specification of the Empirical Model	72
4.6.1	The Propensity Score	72
4.7	Matching Techniques	74
4.8	Data Source	76
4.9	Summary	77
CHAPTER FIVE		78
ANALYSIS AND DISCUSSION.....		78
5.0	Introduction	78
5.1	Summary Descriptive Statistics of Participants and Non-Participants of Urban Agriculture	78
5.2	Determinants of Urban Agriculture Participation in Ghana.....	79

5.3	Propensity Score Matching Results	85
5.4	Sensitivity Analysis.....	88
5.5	Summary	90
CHAPTER SIX.....		92
CONCLUSION AND RECOMMENDATIONS.....		92
6.0	Introduction	92
6.1	Summary of Major Findings	92
6.2	Policy Recommendations.....	94
6.3	Limitations of the Study.....	95
6.4	Suggestion for Further Research.....	96
References.....		97
Appendices.....		111



LIST OF TABLES

Table 2.1 Main Types of Urban and Peri-Urban Crop Farming in Ghana.....	12
Table 2.2 Mean Sizes of Urban Agriculture Participating and Non-Participating Households...18	
Table 2.3 Level of Education of Urban Household Heads (percent).....	20
Table 2.4 Gender of Urban Household Heads.....	21
Table 2.5. Means of Age of Urban Household Heads by Gender.....	22
Table 2.6 Rate of Participation in Urban Agriculture by Region.....	23
Table 2.7 Means of Per Adult Equivalent Real Household Consumption Expenditure by Region.....	24
Table 3.1 Employment in Urban and Peri-Urban Agriculture.....	50
Table 3.2 Economic Impacts of Urban Agriculture.....	51
Table 3.3 Food Produced Through Urban and Peri-Urban Agricultural Activities.....	52
Table 4.1 Definition and Measurement of Variables Used.....	65
Table 5.1 Summary Descriptive of Participants and Non-Participants.....	80
Table 5.2 Marginal Effects of the Logistic Regression Estimating the Probability that a Household Participates in Urban Agriculture in Ghana.....	82
Table 5.3 Indices of Matching Quality.....	87
Table 5.4 Treatment Effects from att* Approach.....	88


LIST OF FIGURES

Figure 4.1 Theoretical Conceptualization of Urban Agriculture.....63

Figure 5.1 Distribution of propensity scores for matched sample.....87



LIST OF ABBREVIATIONS AND ACRONYMS



ATE	Average Treatment Effect
ATT	Average Treatment Effect on the Treated
ATU	Average Treatment Effect on the Untreated
CIA	Conditional Independence Assumption
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GLSS	Ghana Living Standards Survey
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit.
HH	Household
HHH	Household Head
IV	Instrumental Variable
OFY	Operation Feed Yourself
PSM	Propensity Score Matching
RUAF	Resource Centers on Urban Agriculture and Food Security
UA	Urban Agriculture
UN	United Nations
UNDP	United Nations Development Project
UPA	Urban and Peri-Urban Agriculture
WFP	World Food Program

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

Migrations by the rural agrarian to urban areas and the increasing growth of the rural non-farm sector contribute to high unemployment, food insecurity and poverty in urban centers. A report by the United Nations (UN) indicates that the percentage of the world's population residing in cities increased from 37 percent in 1970 to 45 percent in 1995; and this proportion is anticipated to rise above 50 percent by 2050 (United Nations, 1995). Furthermore, the United Nations Population Division projects that about two-thirds of developing countries' population will live in urban centers by 2050 (UNDP, 2008). This rapid urbanization, coupled with the fact that rural non-farm activities hinder agricultural productivity threaten food security, hence negatively affecting household welfare. As a result, urban agriculture has gained prominence in recent times caused by its importance for both income and food. According to Maxwell (2005:15), urban agriculture spurs as a result of a plethora of reasons: rapid urbanization, ineffective agricultural policies, soaring inflation, constrained public spending and subsidies, crippled domestic food systems, rising unemployment, wage cuts, lax land use regulation and plummeting purchasing power.

According to the most widely accepted estimates, urban agriculture and its related activities employ about 200 million people, contributing significantly to the food source of about 800 million urban inhabitants (Nelson, 1996). Furthermore, a global estimate in 1993 reveals that urban food production accounts for about 15-20 percent of the world's food requirement (Armar-Klimesu, 2000). More so, about 40 and 50 percent of urban dwellers in Africa and Latin America respectively are involved in some form of farming activity (Mougeot, 1994; Ruel et al. 1998). Smit et al. (1996) assert that about 800 million individuals are involved in

urban agricultural activities worldwide. Out of this number, about 200 million are market producers who employ 150 million individuals on a permanent basis. Therefore, urban agriculture presents a means of sustaining the livelihoods of most urban low income recipients in emerging economies.

Ravallion (2007) reports that about one-quarter of the poor in emerging economies reside in urban centers. More so, the UN anticipates that about 40-45 percent of Africa's and Asia's poor will be residing in urban centres by 2020 (UN, 2008). This rapid urbanization, as Overman & Venables (2005) claim, is often a positive development, as urban centres are more likely to be productive compared to rural centres, and thus, a driver of economic growth and development. However, this rapid increase in most urban centres' population overstrain the capabilities of such areas to accommodate and provide for this increasing number of dwellers. This is because, most cities in developing countries encounter numerous challenges in managing such expansions, hence are incapable of generating sufficient income earning opportunities (formal and informal) especially for the poor. The Resource Centres on Urban Agriculture and Food Security (RUAF) stresses that rapid urbanization is often accompanied by increasing poverty and food insecurity resulting from increasing food prices, growing unemployment, rising reliance on imports, growing domination of supermarkets and fast food chains and problems caused by climate change which adversely affect household welfare.

Food constitutes a significant component of the expenditure of urban households especially poor households who spend about 60-80 percent of their earnings on food (Maxwell et al. 1999, cited by Armar-Klimesu, 2000). Hence, the ability to obtain income constitutes a major constituent of ensuring household welfare since a substantial amount of food consumed in the urban areas must be purchased. However, most of these households lack the purchasing power

to obtain the adequate food requirement. Mougeot (2006) notes that this income absence transforms more directly into food shortage and malnourishment particularly in urban centres. Urban consumers on average spend about 30 percent extra on food compared to rural dwellers although the average calorie consumption of urban consumers is lower and in most instances insufficient (Argenti, 1998).

Some studies (such as Mougeot, 1998 and UNDP, 1996) have pointed out the potential role of urban agriculture in the alleviation of urban poverty. The income obtained by urban cultivators in some African economies contribute significantly to the maintenance of their households. According to Singh 1989:37, subsistence urban food production can be considered an “unconventional proposal” for remedying the problems of unemployment and poverty in developing countries. This notion is supported by the Food and Agriculture Organization (FAO) which claims that aside urban agriculture’s contribution to the nutritional quality of diets, it may serve as a significant income source for the urban unemployed and underemployed and may also serve as means of utilizing spare and idle land parcels in urban areas (Hussain, 1990).

Income from urban farming activities is particularly high in many less developed countries’ cities. Mougeot (2000) claims that the produce generated through urban agriculture is valued in tens of millions of US Dollars yearly in developing countries’ urban centers. Also, a household’s production of its own foodstuff contributes significantly to reducing the household’s expenditures especially on food (Nugent, 2000).

In many instances, urban food production has been employed by the poor in most urban areas as a livelihood strategy in reaction to insufficient, unpredictable and irregular access to food and the absence of purchasing power (Bowyer-Bower & Drakakis-Smith, 1996). Most urban households engage in urban food production to improve their access and the quality of their food intake.

At the domestic level, urban farming makes available a direct means to a diverse range of nutritious foods for instance fruits, vegetables and meat (Zezza and Tasciotti, 2010). In other words, urban agriculture improves household's welfare through the provision of healthy and ample alternatives for purchased food, particularly for poor families. Hence urban agriculture allows households to minimize their reliance on income, gifts and/or transfers to acquire food though enhancing their access to fresh and healthy foods such as meat, vegetables, eggs and dairy products (Foeken and Mwangi, 2000). For instance, although farmers in Accra earned little income, they produced eighteen (18) months' requirement of their households' staple food consumption needs, as well as employing their yield as an income diversification and consumption-smoothing strategy (Nugent, 2000).

According to some accounts, households involved in urban farming are more probable to be healthier since they have access to an extensive diversity of nutritive diets and animal produces. For instance, in Kampala, Uganda, urban farming has been found to improve the nutritional status of children from households engaged in urban agricultural activities due to enhanced access to an affordable source of proteins (Maxwell et al. 1999). More so, Potutan et al. (1999) claim that urban cultivators consume more vegetables compared to non-urban cultivators within the same wealth group in Cagayan de Oro. In Harare, households involved

in urban agriculture were found to have a healthier breakfast and ate extra protein-rich diet over elongated duration of the year compared to non-farming families (ENDA, 1997).

Urban food production has been found to influence food security positively at the aggregate level (Nguyen, 2000; Purnomohadi, 2000; Mbaye and Moustier, 1999). In addition to the production for individual household consumption requirement, a substantial quantity of the food is made available other groups of the entire population. Mbaye and Moustier (1999) note that Dakar produces about sixty percent of the aggregate vegetable requirement whilst urban poultry production constitutes sixty-five percent of the aggregate consumption requirement. Similarly, Purnomohadi (2000) finds that home gardens cater for about 18 and 14 percent of caloric and protein requirements respectively of the urban population in Java, Indonesia.

Urban food production to a larger degree serves as a complement to rural agriculture (RUAF, 2000). In other words, urban agriculture boosts the efficacy of a country's aggregate food structure. This is in the sense that urban agriculture makes available foods which cannot be easily supplied by rural agriculture such as goods that are highly perishable and necessitate quick delivery for instance vegetables. In addition, it provides foods that can be substituted for imported foods and can also make available rural lands for producing export-oriented commodities.

1.1 Research Motivations and Questions

Over the years, urban agriculture is gradually gaining recognition by urban authorities and civil society establishments due to its capability of strengthening the pliability of the urban food structure, in addition to promoting easy accessibility of most urban residents to healthier diet and creating job opportunities and revenue. The RUAF assert that 'a growing number of cities,

countries and organizations (such as the UN-Habitat, FAO) are recognizing the benefits associated with urban food production and hence are putting in place innovative strategies related to urban agricultural activities or are restructuring current policies'. Thus, strengthening urban agriculture may serve as a significant approach in improving easy availability of fresh and healthy foods which may consequently boost the nutrition of diverse groups of the urban population. The benefits of urban agriculture are numerous and relate to alleviation and/or reduction in poverty, local economic development, improvement in food security, environmental and waste management, community adaptation to climate change and social and community development.

The urban poor are mainly vulnerable to food price hikes because they are generally net consumers and depend regularly on markets for their food provisions (Dessus et al. 2008; Zezza and Tasciotti, 2010). The UN World Food Programme (WFP) notes that for all urban centers in Ghana, about 67 percent of the poor's earnings is spent on food (WFP, 2009). Also, the WFP (2009) finds that about 2 and 4 percent of the 69,000 individuals surveyed in Accra were found to be food insecure and vulnerable to food insecurity respectively.

Recently, increases in urban population in Ghana has rendered the need to find possible solutions that can cater for the accompanying increases in poverty, food insecurity, unemployment, and environmental degradation problems more apparent. Urban agriculture can be harnessed as a strategy for addressing these problems, hence improving household welfare.

The UN-HABITAT (2008) reports that: —" Rather than applying crisis management through ad hoc responses, African governments should consider how they can strategically position themselves for changing urban food requirements and the need for supply strategies and

systems in the short, medium and longer term so that they will continue to be able to feed their increasingly urban societies. Policies are needed that protect (peri-) urban agricultural land, land rights and agricultural livelihoods of the poor. Solutions can be found in stimulating urban and peri-urban agricultural production; improving infrastructure to facilitate inputs into agriculture and outputs from agriculture to cities; and better water management to convert the non-productive territories of the continent to food production for internal use and future export” (p. 34).

However, to date, there exists limited empirical study of the economic impacts of urban agriculture on household welfare in Ghana. This research is therefore necessitated by the need to fill the gap in the economic literature on impacts of urban agriculture on household welfare by providing evidence on the phenomenon from Ghana and hence, contribute to our understanding of the economic dimensions and dynamics of the subject matter. The key research questions to be answered are:

- (i) What is the extent of urban agriculture in Ghana?
- (ii) What factors influence a household’s decision to participate in urban agricultural activities?
- (iii) What are the impacts of urban agriculture on household welfare in Ghana?

1.2 Research Objectives

The study aims to empirically analyze the extent of urban agriculture in Ghana. Specifically, this study assesses the rate of participation of urban agriculture in Ghana. In addition, the study investigates the factors that influence an urban household’s decision to participate in agriculture.

The second part of the study focuses on examining the impacts of urban agriculture on household welfare. In other words, this study sets out to examine whether or not urban agriculture has a role to play in improving household welfare. Thus, the study analyses whether an urban household's participation in agriculture has any significant impacts on its welfare status.

1.3 Justification of the Study

The recent increase in the population of most Ghanaian cities (resulting from migration and rising population growth rates) has resulted in a growing poverty, food insecurity, and intensifying problems to access healthier foodstuff at reasonable prices. The Ghana Shared Growth and Development Agenda (2010) projects a 3 percent average urban growth rate between the years 2000 and 2030. With this 3 percent average growth rate, the Ghanaian urban population is estimated to rise from an average of 52 percent of the country's 2010 population to an average of 65 percent by 2030. This rapid growth in urban population decreases most urban households' welfare due to its accompanying adverse effects.

The relevance of this study stems from the need to undertake a country-specific empirical analysis of urban agriculture to deepen our understanding of the impact of the practice on household welfare. With increasing incidence of deteriorating household welfare due to increasing unemployment, poverty and food insecurity in Ghana, knowledge of the economic consequence of urban agricultural activities is relevant for designing policies that aim at improving household welfare. This study focuses on the aggregate impact of urban agricultural activities on households' welfare in Ghana.

This study will also fill existing literature gaps on urban households' livelihood strategies in response to inadequate income-earning opportunities. In addition, this study will provide evidence on the determinants of an urban household's decision to participate in agricultural activities in Ghana.

1.4 Organization of the Study

This study comprises six chapters. The rest of the study is organized as follows: Chapter two provides an overview of urban agriculture in Ghana. The chapter discusses the nature, participants and the rate of participation of the phenomenon in Ghana. The third chapter provides a review of both theoretical and empirical literature on the practice of urban agriculture. Chapter four looks at the methodology and data used for this study. Chapter five presents the results and discussions of the empirical analysis of the study. Chapter six concludes the study by providing a summary and a discussion of the policy implications of the findings as well as limitations and suggestions for future research.



CHAPTER TWO

OVERVIEW OF URBAN AGRICULTURE IN GHANA

2.0 Introduction

The chapter provides an overview of urban agriculture in Ghana. The chapter provides a brief historical overview as well as the forms of urban agriculture in Ghana. Also, it discusses the contributions of urban agriculture to household welfare with evidence from Ghana. It further looks at the household characteristics of participants and the distribution and rate of participation of urban agriculture in Ghana. Finally, the chapter outlines some challenges faced by urban farmers as well as integrating urban farming activities into urban planning in Ghana.

2.1 Brief Historical Overview of Urban Agriculture in Ghana

Urban vegetable cultivation was introduced into Ghanaian urban centres by the British colonial administrators (La Anyane, 1963). Primarily, the cultivation of exotic vegetables and ornamental plants were mainly to respectively provide food and beautify the homes of the Europeans. However, these cultivations were only restricted to the homes of the European civil servants, merchants and also the castles and forts functioning both as the seat of government and the residences of the colonial administrators (Asomoani-Boateng, 2002). Although urban vegetable cultivation was promoted by the British colonial administrators, they neither permitted livestock/poultry rearing nor the production of local foodstuff for health reasons (Asomoani-Boateng, 2002). Crops being cultivated within the urban peripheries as well as animals found wandering were destroyed and offenders arraigned for compromising the health of the city.

Between 1972 and 1976, urban agriculture assumed prominence in Ghana as a result of unfavorable economic environments following the currency devaluation, large external debt

and later, drought. These consequently resulted into acute shortage of food. According to Asomani-Boateng (2002), the supply of food for the nation's populace became a major problem owing to food price hikes particularly in most cities as a result of these harsh economic conditions and severe drought.

In response to this food shortage, the then government instituted a program known as the Operation Feed Yourself (OFY). This program sought to encourage farming within the urban peripheries as a result of the unfavorable economic environment and its associated acute food shortage. Hansen (1987) describes the OFY program as the most determined program in response to the country's acute food shortage.

The OFY was a crash program which was directed at enhancing both the production of food and the promotion of aggregate self-sufficiency by encouraging both urban as well as rural dwellers to cultivate their own food (Asomani-Boateng, 2002). As a result, urban agricultural activities were allowed and strict conventions and regulations restraining the phenomenon were relaxed. These afforded urban dwellers the chance to cultivate their food crops and raise animals without fear of being persecuted or having their farms and/or animals destroyed by the authorities. Urban dwellers were therefore encouraged to cultivate accessible land around the cities so as to improve the stock of food (Asomani-Boateng, 2002).

2.2 Forms of Urban Agriculture in Ghana

There exist diversities in urban agricultural production systems in Ghana. Cofie et al. (2005) find that in Accra, these systems include crop and non-crop production, inputs and the delivery of service as well as the processing and marketing of urban agricultural produce. Crop production system embraces: home-based gardening which mostly occurs in the yards of

several homes; open space or off-plot exclusive cropping which is mostly for the production of market oriented vegetables and seasonal mixed crop farming which takes place mostly in undeveloped community and inhabited spaces, along river and road banks, spaces beside drainage systems, swamplands, abandoned waste dumps, etc. (Cofie et al. 2005). On the other hand, non-crop production systems involve poultry farming, raising of small ruminants, floriculture, aquaculture, dairy production and species like mushroom etc. that are short cycled.

Drechsel et al. (2006) find two main forms of urban crop farming in Ghana:

- (i) Open-space farming aimed for the city market, and
- (ii) Backyard gardens primarily but not only for household consumption.

Table 2.1 Main types of urban and peri-urban crop farming in Ghana

Farming Systems	Urban Regions	Peri-Urban Regions
Market production (mostly takes place on undeveloped urban spaces)	Irrigated vegetables (this could be all-year round or seasonal), ornamentals and flowers; rain-fed cereals.	Irrigated vegetables (usually periodic), fruits; rain-fed cereals
Subsistence cultivation (production in and around the residence)	Backyard or front yard cultivation	Home-based gardens, production around the residence

Source: Drechsel et al. (2006)

In Accra, the capital of Ghana, Armar-Klemesu (2000) finds that irrigated vegetable production constitutes the dominant agricultural activity which generally takes place along streams and drains in up to seven open spaces in the city. During the dry season, the commonly produced vegetables include *alefi*, *ayoyo*, cabbage, lettuce, cauliflower, spring onion, green pepper and

onions whereas maize and okro are cultivated in the wet season in addition. Also, some households engage in backyard gardening besides open space farming.

2.3 Importance of Agriculture to Ghana's Economy

Agriculture remains one of Ghana's most important economic sectors, employing a sizeable share of the nation's populace formally and informally and accounting for a substantial fraction of the economy's gross domestic product (GDP) and export earnings. There exist diversities in the types of crops produced depending on the climatic zone which varies from dry savanna to wet forest. Crops produced include cocoa, timber, cassava, grains, yams, oil palms, and kola nuts.

Agriculture plays a substantial role in promoting growth and poverty alleviation in the Ghanaian economy by contributing significantly to government revenue. Asuming-Brempong (2004) asserts that the agricultural sector contributes significantly to the growth of the Ghanaian economy. A significant proportion of this contribution is obtained through the payment of duties on the export of agricultural products, particularly cocoa which remains an important contributor to the economy's foreign exchange earnings over the period. The proportion of the agricultural sector's contribution to the nation's foreign exchange earnings totaled 38.5%, 35.4%, 33.9%, and 35.5% from 1999 to 2002 respectively (Asuming-Brempong, 2004). These earnings were mainly obtained from exporting agricultural products and conserving foreign exchange through the production of import-substituting goods and raw materials. Furthermore, the agricultural sector serves as a source of employment for a substantial number of the Ghanaian population.

The agricultural sector further contributes to both the household and national food security. The sector contributes directly by making food easily accessible through the provision of a

significant proportion of country's annual food requirements. Through the sector's contributions to foreign earnings, the country becomes capable of importing the shortfall in the national production in order to cater for the demand requirement. Indirectly, the sector contributes to food security through its creation of employment opportunities for a significant proportion of the economy's active population, thus enabling them to gain access to the available food through income that will be obtained.

The sector further contributes significantly to the environment through its multifunctional roles (Heather, 2012). It generates positive externalities such as improvement and conservation of soil quality, minimized soil erosion, restoration of soil fertility through tree cover, reduction in greenhouse gas emissions through carbon sequestration and the protection of watershed and catchment areas. However, negative externalities such as soil erosion, flooding, deforestation, soil degradation and pollutants are also generated.

2.4 The Potential Role of Urban Agriculture in Ghana

Urban agriculture can potentially enhance the local economic development of the country as a whole in many ways. The increasing population of the country's urban centres with its accompanying increases in unemployment, food insecurity and poverty, together with rural agriculture's inability to supply sufficient food at affordable prices have rendered the need for alternative viable strategies more apparent. The RUAF (2010) argues that 'urban agriculture complements rural agriculture, improves urban food supply, stabilizes market and saves economic resources by readily providing food instead of expensive provision from outside the towns'. Asomani-Boateng (2002) asserts that in Ghanaian cities, urban agriculture remains an unexploited and wasted prospect that must be tapped into in the nation's pursuit of sustainable urban development.

As an informal sector activity, urban agriculture potentially provides a dependable and/or alternate source of revenue for a significant number of the people in the country. For instance, Cofie et al. (2005) find that in Accra, open-space vegetable production provides a support system for about 1000 farmers and could produce per monthly income that was higher than the US\$27/month per capita. Danso et al. (2002) further highlight the indirect social benefits obtained from the direct economic advantages of urban agriculture such as the ability to cater for school expenses, securing extra assets, accessing better healthcare which consequently results in improvements in livelihoods. In addition, urban agriculture provides a means for improving the household's budget since a significant portion of the household's food requirement is self-produced. Thus, it provides a means of supporting one's primary occupation from the sales of surpluses.

More so, urban food production considerably improves urban households' food security by making food easily accessible and affordable. Food security occurs when all people have physical, economic and social access to sufficient, safe and nutritious food at all times to meet their dietary needs and food preferences for a healthy life. Cofie et al. (2005) find that in Accra, about 50 percent of all households operate some form of backyard garden where they produce food and/or rear small animals purposely for self-consumption. In Accra, above 80 percent of spring onions and lettuce consumed is obtained through urban open- space vegetable production (Drechsel, 2005). Thus, households that participate in urban agriculture get access to food especially fresh vegetables and animal by-products. Also, food is made available at the aggregate level through the sale of surplus on the markets. Appeaning Addo (2010) notes that urban farming significantly contributes to the food security of nearly 50 percent of the world's urban populace.

Furthermore, urban agriculture potentially provides a means of managing urban spaces. Asomani-Boateng (2002) asserts that the conversion of open and vacant lands into agricultural spaces can aid in cleaning up these spaces and convert them into hygienic green regions at a minimum or no cost to city officials, leading to a reduced municipal and landscape maintenance cost.

The quick increase in the Ghanaian urban population has been associated with increases in the amount of waste generated daily. The collection and disposal of the generated waste remain a critical challenge for city officials in the country. As a result, a significant proportion of the waste generated is left uncollected and these end up in open spaces, drainage channels and streams which consequently create severe health and environmental problems. Asomani-Boateng (1999) finds that a total of 700 to 800 tons of waste is generated in Accra daily of which 540 tons can be recycled into agriculture. Thus, urban agriculture presents an opportunity to recycle urban organic waste and in so doing, improve the efficiency of the various agricultural systems as well as environmental health. The recycling of organic waste into urban agriculture will contribute significantly to waste reduction and a better environment. Drechsel et al. (2005) find that 18 percent of organic waste can be recycled by the real estate development sector for gardening and landscaping.

Urban agricultural activities improve the stability of food prices and aid in lowering the cost of similar agrarian products imported from outside the country. This results in an improvement in household welfare since foodstuffs will be sold at reasonable prices.

2.5 The Structure of Urban Households in Ghana

This section gives a description of urban household characteristics with emphasis on the differences between participating and non-participating households.

2.5.1 Household Size

Data from the 2012/13 Ghana Living Standards Survey (GLSS 6) suggest that the average size of urban households in Ghana is 3.6 persons. However, there exist differences in the sizes of households participating in urban agriculture and non-participants. Whilst the average size of urban agriculture-participating households is 4.5 persons, non-participating households are estimated to be 3.3 persons. From these figures, it can be realized that the average household size of participating households is greater than that of non-participating households. We can therefore postulate that these households engage in urban farming activities as a means of enhancing their access to food to feed the large numbers, hence improving their food security status. On the other hand, it can also be argued that these households engage in urban farming activities because labor can be provided by the large household members. Table 2.2 displays the average household sizes of participating and non-participating households by region.



Table 2.2 Mean Sizes of Urban Agriculture-Participating and Non-Participating Households

Region	Participating Households (No. of persons)	Non-Participating Households (No. of persons)	Total (No. of persons)
Western	4.982	3.387	3.803
Central	3.866	3.194	3.374
Greater Accra	4.658	3.356	3.412
Volta	4.645	3.182	3.839
Eastern	4.356	2.949	3.595
Ashanti	4.165	3.293	3.520
Brong Ahafo	4.584	2.935	3.852
Northern	5.252	3.433	4.446
Upper East	4.905	3.361	4.266
Upper West	5.259	3.439	4.254
Total Average	4.529	3.277	3.611

Source: Author's computation based on 2012/13 GLSS Data

2.6 Characteristics of Urban Household Heads

The characteristics of a household head in terms of gender, age, and education are important indicators of the household's welfare or economic status. A person's ability to secure a well-paying employment may be affected by his/her educational attainment. Thus, well-educated households are more likely to have better levels of welfare outcomes and are less likely to participate in urban farming activities.

Estimates from the GLSS 6 data indicate that about 45.5 percent of heads of urban agricultural households have no formal education as compared to 25.4 percent of non-urban agricultural households. Of the urban agricultural households with formally educated heads, 37.3 percent had completed basic education, 8.5 percent had attained secondary education, 2.3 percent had attained some form of vocational education and 6.5 percent had attained post-secondary education. On the other hand, of the non-urban agricultural households with formally educated heads, 39.3 percent, 15.3 percent, 5.9 percent and 14.2 percent had attained basic, secondary, vocational and post-secondary education respectively. Table 2.3 shows the level of education attained by urban household heads by status of participation.



Table 2.3 Level of education of Urban Household Heads by Participation

Level of Education	UA Households (%)	Non-UA Households (%)	Total (%)
No education	45.46	25.36	30.72
Basic	37.30	39.27	38.74
Secondary	8.45	15.29	13.47
Vocational	2.27	14.17	12.13
Post-Secondary	6.52	14.17	12.13
Total	100	100	100

Source: Author's computation based on 2012/13 GLSS Data

The findings of studies (such as Tripp 1990; Sanyal, 1984) from some African countries suggest that more women participate in urban agricultural activities than men. However, in Ghana, urban food cultivation is dominated by males (Asomani-Boateng, (2002); Armarm-Klemesu and Maxwell, (1998); CENCOSAD, (1994)).

Data from the 2012/13 Ghana Living Standards Survey (GLSS 6) indicates that a significant proportion of households participating in urban agriculture are headed by males compared to females. 71.5 percent of urban agricultural households are male-headed while 28.5 percent are female-headed. On the other hand, 63.9 percent of non-participating households are headed by males while 36.2 percent are headed by females. This is shown in table 2.4

Table 2.4 Gender of Household Heads

Gender of HH Head	UA Households (%)	Non-UA Households (%)	Total (%)
Female	28.47	36.18	34.12
Male	71.53	63.82	65.88
Total	100	100	100

Source: Author's computation based on 2012/13 GLSS Data

The age of household head affects the household's involvement in urban farming activities. Some studies have concluded that urban agriculture is dominated by households with older heads (e.g. Dossa et al. 2011). On the contrary, studies such as Jongwe (2014) finds that urban agricultural households have younger heads compared to non-urban agricultural households.

Computations from the GLSS 6 indicate that the mean age of heads of urban agricultural households (48.9 years) is higher than the mean age of heads of non-urban agricultural households (41.6 years). Thus, urban households participating in some form of agriculture have older heads compared to non-participating households. There however exist some disparities in the mean age of male-headed and female-headed urban agricultural households. The mean age of female-headed urban agricultural households is 53.2 years while that of male-headed urban agricultural households is 47.2 years. This is represented in table 2.5 below.

Table 2.5 Means of Age of Household Head

Sex of Household head	UA Households (years)	Non-UA Households (years)	Total (years)
Female	53.228	43.665	45.793
Male	47.187	40.371	42.345
Total (years)	48.907	41.563	43.522

Source: Author's computation based on 2012/13 GLSS Data

2.7 Distribution of Urban Agriculture in Ghana

The location of the household informs the household's decision to engage in urban farming activities. This is because the necessary factors such as land that are very crucial in the household's decision to participate in the activity may be more easily obtained in some areas than in others. Computations from the GLSS 6 indicate that 2,265 households out of the total 7,445 urban households surveyed participate in farming activities. Thus, the number of urban households involved in farming activities constitute 30.4 percent of the total urban households.

Brong Ahafo region constitutes the region with the highest rate of participation. This is followed by Eastern region, Northern region, Ashanti region and then Volta region. Greater Accra region constitutes the region with the least rate of participation in urban farming activities. This low rate of participation may be attributed to increases in the region's population and the competitive use of land for more valued urban development projects such as estate development. Table 2.6 illustrates the degree of participation in urban farming activities by region.

Table 2.6 Rate of Participation in Urban Agriculture by Region.

Region	Frequency (No. of households)
Brong Ahafo	377
Eastern	368
Northern	280
Ashanti	238
Volta	233
Central	213
Western	195
Upper East	189
Upper West	97
Greater Accra	75
Total	2,265

Source: Author's computation based on 2012/13 GLSS Data

2.8 Urban Agriculture and Household Welfare

The level of welfare of households participating in urban farming activities has been found to be higher than that of non-participating household. This may be attributed to the fact that a substantial share of the household's food requirement can be obtained through the household's

Table 2.7 Annual Means of Per Adult Equivalent Real Household Consumption Expenditure by Regions

Region	UA households (Ghana cedis)	Non-UA households (Ghana cedis)	Total (Ghana cedis)
Western	3298.674	4950.604	4519.581
Central	3384.822	4024.676	3852.108
Greater Accra	5849.333	5738.839	5743.567
Volta	3412.999	4178.358	3834.857
Eastern	3252.458	4351.501	3846.653
Ashanti	3569.750	5118.3845	4715.682
Brong Ahafo	3431.412	3794.103	3592.374
Northern	2433.753	3548.636	2927.793
Upper East	3069.108	2977.548	3031.178
Upper West	3086.047	4414.866	3820.286
Total	3417.508	5050.339	4614.789

Source: Author's computation based on 2012/13 GLSS Data

own production. This consequently results in a reduction in the household's consumption expenditure. Computations from the GLSS 6 data reveal that the real household consumption expenditure per adult equivalent for urban agricultural households is less than that of non-urban agricultural households. The annual real household consumption expenditure per adult

equivalent for urban agricultural households is 3417.5 Ghana cedis while that of non-urban agricultural households is 5050.3 Ghana cedis. However, the real household consumption expenditure per adult equivalent for urban agricultural households in the Greater Accra region is greater than that of non-urban agricultural households. Table 2.7 gives a breakdown of per adult equivalent real household consumption expenditure by region.

2.9 Problems of Urban Farmers in Ghana

Like urban farmers everywhere, urban farmers in Ghana are faced with a number of challenges in their farming activities. The most common problem faced by these farmers is land insecurity. Land parcels in most urban areas are not allocated for agricultural activities. Most urban cultivators lack tenure or security over lands on which they farm. This creates fear among the farmers since they can lose their farms at any point in time. Asomani-Boateng (2002) finds that farmers in Accra are subjected to threats of eviction from wealthy individuals due to their lack of tenure rights to the land on which they cultivate. Thus, they are unable to defend themselves and their farms from these wealthy persons. Also, the accessibility to land at appropriate places constitutes another dimension of the problem. Most farmers find it difficult to find fertile land that is close to their homes (Asomani-Boateng, 2002).

Accessing safe but affordable water for irrigation also constitutes a significant challenge. This results in most farmers using wastewater which contains a range of pathogens and pollutants for irrigation. This is because, wastewater offers a more regular source of water supply due to its continuous flow and the fact that they do not incur cost as compared to the use of pipe-borne water. Water supply in most urban centers in Ghana is often inadequate, which render it undependable. Wastewater mostly contains excreta-related pathogen and skin irritants. These pathogens and pollutants can affect human health, soils and/or crops. This has resulted in

public concern about the health implications of irrigation with waste water (Gyasi et al. 2014) since most of the crops, especially vegetables, are eaten raw e.g. lettuce, cabbage, etc.

Furthermore, high cost of farm inputs and agrochemicals such as fertilizers, pesticides and insecticides poses a challenge to most farmers. Most urban dwellers find it difficult to cultivate as a result of the high cost of farm inputs and agrochemicals. This consequently results in farmers using cheap and/or toxic alternatives. For instance, as a substitute for chemical fertilizers, most vegetable growers in Accra use cow and chicken manure and compost because they are cheaper (Asomani-Boateng, 2002).

Drought and floods also pose a challenge to many urban farmers in Ghana. Due to unavailability of land in the urban centers, most farms are situated in swamplands and along drainage channels and streams. Thus, these farms are highly prone to floods especially in the rainy seasons resulting in heavy losses. Farmers in Ghana are very dependent on rainfall as their main source of water for their crops, subjecting them to uncertainties. In periods where the amount of rainfall is inadequate, most farmers suffer poor harvests.

Another challenge faced by these farmers is their lack of access to credit. Most banks and micro-finance institution seldom give loans and financial assistance to farmers due to their inability to provide collaterals. Also, most credit institutions perceive financing agriculture as risky due to the uncertainties surrounding farming activities. This lack of access to financing constitutes a significant bottleneck in their ability to maintain and expand their activities. Consequently, most farmers fund themselves by making arrangements with market women or buyers. These arrangements involve the buyer giving the farmer an advance payment which is settled with delivery of their produce.

Drechsel and Keraita (2014) observe three major constraints or reasons that reduce the chances or prevent urban farmers from easily accessing financial services such as loans from banks etc. These are farmer characteristics, organizational capacity of financial institutions and the macro environment with farmer characteristics constituting the primary constraint.

Farmer characteristics include gender, age, residential status, religious affiliation, major occupation, scale of production, technologies employed, type of business, affiliation to a formal producer organization and gross monthly earnings. Based on these characteristics, Drechsel and Keraita (2014) assert that urban agriculturalists are mostly high-risk cases. Hence, lenders especially formal financial institutions employ precautionary measures in an attempt to reduce the risks of default. These measures comprise screening exercises to eliminate potential borrowers who may be unable to pay the loan, creating favorable incentives to aid successful borrowers in repaying their loan and putting in place various enforcement strategies to ensure successful repayment. (Nathan et al., 2004 cited in Drechsel and Keraita, (2014)).

The main objective of financial institutions is to make profit. Thus, these institutions will prefer projects that promise high returns and repayment rates. A lot of financial institutions feel reluctant to lend to farmers particularly because their activities are mostly on small scale and, hence do not promise higher returns.

Another significant challenge faced by urban farmers is their lack of access to extension services. Consequently, most farmers are left with the option of depending on their limited knowledge especially in the usage of chemicals. Mostly, these farmers apply these chemical substances with no form of official assistance, with its adverse implications on the farmer's and consumer's health and that on the environment. For instance, the use of pesticides in urban

farming is found to have adverse consequences such as impotency and infertility in men and women respectively in Ghana (Mensah et al. 2001). Also, there is a higher chance of polluting water bodies from the application of chemicals since most farms are located near streams.

The highly labor intensive and tedious nature of farming in most urban centers negatively impact the farmers' health. A significant number of these farmers use traditional tools such as cutlasses and hoes in their operations. Also, in the quest for irrigation, most farmers have to walk long distances to fetch water in order to carry out the activity. These tedious activities sap their energies and affect their health negatively. Furthermore, most of these farmers may not wear protective clothing during irrigation and application of chemicals, thus resulting in skin diseases. In addition to the above challenges are injuries from cuts and animal bites such as snakebites. However, most of these farmers who suffer these injuries are unable to access healthcare treatment due to the expensive nature of healthcare in most cities.

2.10 Urban Agriculture and Urban Planning in Ghana

There seem to be a conflict between urban land usage design and urban agriculture in most towns and cities in Ghana. Land use in many urban centers in Ghana has failed to cater for urban farming activities due to increases in population and the competitive usage of land for highly appreciated urban development projects such as estate development. Agricultural lands are increasingly being converted into residential use in most urban centers in Ghana. For instance, Odame-Larbi (1996) estimated that between 1990 and 1993, approximately 2100 hectares of agricultural land was used for residential and industrial purposes per year; by 1997, the figure had increased to 2600 hectares yearly.

Cofie et al. (2005) assert that there exist no detailed policies on urban agriculture neither is it incorporated permanently into the general micro-economic level development policies in Ghana. The authors further highlighted that even though no urban agriculture specific policies exist, small holder agriculture development has been emphasized in key projects, policies and programs such as Capital City and Decentralization Policy. However, these have not improved the growth of urban agriculture, thus the need for better incorporation of urban agriculture into the general urban development policies and programs. The lack of policy support has made it difficult to protect and support people involved in the activity. Hence, there is the need for the development of institutional policies and legislative framework that would promote urban agriculture as a critical component of the development process. This involves educating and creating public awareness of urban agriculture to assist the public in their decision to engage in urban agriculture or not. In addition, there is need to build capacity for farmer associations with the urban areas which will provide assistance to farmers in terms of accessing credit and farm inputs, educate the farmers on the use of appropriate technology and application of chemicals and also in book keeping.

Furthermore, there is the need for city authorities to demarcate open spaces for the various forms of urban agriculture. Asomani-Boateng (2002) asserts that urban farming has urban planning consequences in the sense that decisions pertaining to the planning of land usage concern the type, size and location of land. That is, in designing urban land uses, urban planners must answer the questions; ‘is this use appropriate on this site’; ‘where is this use most suitably located?’; ‘are the uses located on the same site or adjacent sites compatible with one another’; and ‘how much land is needed for a particular use’ (Asomani-Boateng, 2002). In light of this, Cofie et al. (2005) conclude that urban agriculture presents multifaceted connections of social and environmental phenomena, thus, the future habitability of cities will be contingent on

whether or not authorities and urban developers put in place and stick to coherent policies for the management of urban and peri-urban areas.



CHAPTER THREE

REVIEW OF LITERATURE

3.0 Introduction

This chapter provides a review of literature on the practice of urban agriculture. Specifically, the chapter focuses on the theoretical foundations for explaining an urban household's decision to participate in urban farming activities as well as empirical studies on the concept, determinants, participants and consequences of urban agriculture.

3.1 Theoretical Literature

3.1.1 Urban Agriculture at the Household Level.

Studies on urban agriculture have provided little theoretical framework for explaining and assessing the factors that determine an urban household's decision to engage in urban agricultural activities. Nugent (2000) models an urban household's decision to partake in urban farming as a reflection of the household's attempt to maximize its wellbeing amongst employment options including leisure subject to a set of constraints. This model is based on the assumption that households are confronted with options with regards to how they allocate their labor and expenditures in an attempt to optimize their wellbeing from a given constraint of limited resources. Thus, members of a household decide jointly how best to assign their available time to the maximum rewarding activities over a given period.

Nugent (2000) highlights that the maximization problem becomes more complicated given the fact that urban cultivators are suppliers of labor to agriculture, producers as well as users of the output. Therefore, in an attempt to comprehend an urban household's behavior regarding urban agriculture, other elements that influence earnings should be considered in the study. Some key economic complications include imperfect labor and land market in urban centres, poor quality

or non-existent inputs markets and unreliable market information (Nugent 2000). According to the author, there is a likelihood that the definition of a household's welfare becomes complicated to involve the adaptation to underemployment, diversification of income sources, and other factors that improve the household's welfare under uncertainty. In addition to these are extra influences for instance traditional norms, perception of risk, family gender relationships and social expectations which the household may consider more essential.

On a microeconomic level, the decision by an urban household to participate in urban agriculture results in variations in the allocation of time and expenditure by the household (Nugent, 2000). Hence, from the point of view of the household as labor suppliers, a household will cultivate its own food (that is engage in urban agriculture) if the returns (either monetary or in-kind) from the farming activity is higher than other activities for the efforts expended. Thus, an urban household will participate in urban farming activities if and only if the benefits obtained from farming are higher than that of other activities available to the household.

From the viewpoint of the household as a consumer, it will participate in urban farming to produce its food requirement if it relatively costs less (with regards to time and money) compared to buying food. Thus, the amount of energy a household puts into urban farming is obtained from the constrained optimization problem of the household's welfare.

Objective: Maximize household's wellbeing from employment options as well as leisure.

Constraint: 1. Household resources for instance capital, labor and a set of skills.

2. Prices of and access to foodstuffs and other consumables.

3. Prices of and access to needed inputs, including land.

4. Risks and uncertainties about markets, policies and weather.

In conclusion, Nugent (2000) asserts that urban cultivators employ a mixed approach of food supplementation and risk minimization. Thus, diverse motivations for urban farming require different amounts of efforts. For instance, a part-time cultivation can provide sufficient food quantity to cater for a household's requirements for vegetables, fruits etc. Therefore, urban cultivators react to various chances such as, income enhancement, availability of land and other conducive factors for crop cultivation.

This model may be criticized for some reasons. The model may face a reality which might be much more complex than implied by the theory. This is because the behavioral and economic incentives faced by households may differ even within the same environment. Thus, the decision by urban households to engage in farming and the amount of effort allocated to urban farming activities may not be directly related to prices, income, employment opportunities, etc. However, in spite of these limitations, the theory offers some useful insights into a household's urban agriculture decision making behavior.

3.2 Empirical Literature

This section presents a review of empirical studies on the concept, determinants, participants and consequences of urban households' participation in agriculture.

The first French geographical accounts of urban agriculture were published on Central Africa in the 1960s. Since then, scattered and isolated surveys by individuals like Egziabher et al. (1994) have given way to institutional projects. In general, a considerable number of researches

have been conducted on urban agriculture in all its aspects but studies in Ghana are very limited.

3.2.1 The Concept of Urban Agriculture

Generally, there exist no brief definition of urban agriculture. However, it has been established that attempts to describe it must be purposeful to render it distinctive in content and form.

According to Mougeot (1996), the definition of urban agriculture must adopt the significant attribute that renders it urban; that is, it should be incorporated into the urban economic and ecological structure. He further emphasizes that the concept will be insignificant on policy, scientific and technological fronts if the urban dimension is not heightened and made operational. Stevenson et al. (1996) on the other hand stress the need to differentiate between peri-urban farming and agriculture in the 'peri-urban zone'.

In an attempt to differentiate between urban and rural agriculture, Moustier (1998), defines urban agriculture as agriculture which is operated inside or on the peripheries of an urban centre where a non-farming usage of domestic resources remains an important choice; rural agriculture takes place in regions where this preference is not a concern. The most common feature of urban agriculture definitions in most studies is location within and/or around urban centers (Smit et al. 1996; Sawio, 1993).

Urban agriculture is fundamentally theorized in a common structure of building blocks model.

- Types of economic activities;
- Food/nonfood categories of products and subcategories;

- Intra-urban and peri-urban character of location;
- Types of location where it is practiced;
- Types of production systems;
- Product destination and;
- Production scales.

3.2.1.1 Type of Economic Activities

Here, most definitions of urban agriculture emphasize the production stage of farming. However, some current definitions include processing and trade and also place emphasis on interactions between them. Here, Mougeot (2000) highlights that commodity analysis, in addition to its exhaustive nature, affords a strategy which is integrated and principally pertinent to urban agriculture where, unlike rural food farming, production and marketing is likely to be highly interconnected in time and space, due to higher geographic closeness and faster resource movement.

3.2.1.2 Food/Non-Food Categories of Products and Subcategories

Most definitions in this category highlight food productions suitable for either human or livestock consumption. These are mostly grown or cultivated food products (such as vegetables, grains, medicinal herbs, fruits and livestock). However, some of these definitions also embrace different agricultural manufactures. A small number of these definitions focus on ornamental and agro- industrial plants for instance tobacco and silk worms. Among the food crops, much emphasis is placed on the highly perishable and appreciated vegetables and animal produce. More so, some studies have exclusively concentrated on food production,

whereas others include both food and non-food production (Mougeot, 2000). Mougeot (2000) further stresses that excluding non-food group from the urban agricultural notion would result in a truncation of the general understanding of the urban agriculture structure as a whole.

3.2.1.3 Intra-Urban and Peri-Urban Character of Location

This remains the common component of several urban agriculture definitions in the literature (such as Smit et al. 1996b; Sawio, 1993), that is, ‘in and around cities or urban areas’. A few studies have actually distinguished between intra- and peri-urban locations. For intra-urban agriculture, criteria used include density thresholds, size of the population, city boundaries (Murray, 1997); the city’s public limits (Maxwell & Armar-Klemesu, 1998); agrarian usage of land for other purposes (Mbiba, 1994). Moustier, (1998) compares urban and rural agriculture by defining urban agriculture as one which takes place within and/or around the peripheries of a metropolis where a non-farming usage of resources is a real choice; rural farming occurs in regions where this decision is not a question. More so, many authors recognize the benefits of distinguishing between peri-urban and intra-urban agriculture, though varied criteria are employed. For example, a peri-urban location is where “the advantages of combining farm and non-farm work can be maximized” (Swindell, quoted by Binns & Lynch, 1998).

3.2.1.4 Type of Area

The type of area where urban farming activities take place is another criterion. Such areas differ from one author to the other. These include; residence site (that is on-plot or off-plot); developed nature of location (built up vs. open space); tenure of area (lease, authorized or unauthorized-through personal agreement, sharing, or customary law); the authorized usage type of the area where urban agriculture takes place (such as industrial residential and/or institutional). Studies such as Lee-Smith et al. (1987) concentrated on home plot areas while

others such as Mbiba 1994; Dennerly 1996 and del Rosario 1999 focused on open space locations. However, some studies have included on-plot and off-plot sites, under diverse tenure schemes, bringing out the innovative connections existing among such locational classifications (Sawio, (1993); Maxwell, (1995))

3.2.1.5 Product Destination

The destination of the product is another criterion of urban agriculture definitions. Here, most of the definitions embrace agricultural productions aimed at both self-consumption and some trade. Recently, most economic studies have been targeted at specific (export) market-oriented production which has facilitated the understanding of the economic performance of urban production and its associated benefits. Here, Mougeot (2000) stresses that at the household consumption level, extra emphasis should be placed on the contribution of the economics of animal assets. For instance, although minimum focus was given to the asset worth of small livestock in Accra, it was revealed in a Cairo study that almost 30 percent of low income households in informal housing obtained an average of a whole month's earning worth of livestock. (GTZ, 1999).

3.2.1.6 Production Systems/Scale of Production

Few definitions of urban agriculture take account of the diverse forms of production systems a priori. Generally, much attention has been given to individual/household, small and medium systems compared to large, nationwide or international activities. Recent studies have however indicated that bigger market oriented units interrelate in more varied ways with their smaller counterparts, mostly even at the expense of units principally for self-consumption (Mougeot, 2000).

3.3 Determinants of Household Urban Agriculture Participation Decision

A considerable number of studies have been carried out to identify the social, economic and cultural factors that influence a household's decision to engage in urban agricultural activities.

Maxwell et al. (1998) studied whether urban farming aids in the prevention of malnutrition in Kampala. The authors noted that most households engaged in urban agricultural activities due to the rising cost of living during the period of economic crisis. This result is also confirmed by Hovorka et al. (2009) who highlight that political or economic disaster encourages urban farming, which may serve as a safety net for the poor and also for families seeking to supplement their declining earnings. In their study of Kampala, Maxwell et al. (1998) found that during the period of economic crisis, most women were charged with the responsibility of providing food for their households, but lack, in various instances, the means to adequately do so. Hence, most of these women engaged in various farming activities to secure for their households a food source and also income through the sale of surplus produce.

Similarly, in Ghana, a programme known as the Operation Feed Yourself (OFY) was instituted in the mid 1970's as a response to a food shortage resulting from a series of crises (Asomani-Boateng, 2002). The resultant food shortage crises arising from these crises made it very difficult to supply the needed food requirement for the urban dwellers in most cities. Thus, this program sought to encourage urban residents to cultivate any open space in the cities to increase food supply.

Adebesi and Monisola (2012) studied the motivation for women's participation in urban agricultural activities in Nigeria. The study identified three main factors, namely, access to land, income supplement and food security, accounting for 98.6 percent as the most significant determinants of urban female's participation in agricultural activities. Using a stepwise

multiple regression analysis, Adebese and Monisola (2012) identified food security as the significant factor for women's participation in urban farming. Most women engaged in urban farming firstly to ensure their households' food security due to continuous increases in the prices of goods in Nigeria.

Furthermore, Adebese and Monisola (2012) argued that most women participated in urban farming in order to supplement their household income. Thus, most women participated as a result of the income that will be obtained. They obtain income directly from the sale of their output (surplus) and indirectly from the reduction of expenditure on food as a result of the household producing a significant proportion of its consumption needs.

Lastly, a household's accessibility to land positively affects its decision to partake in urban farming activities (Adebese and Monisola, 2012). Land constitutes a significant component of the decision to participate in urban farming. Thus, women with easy access to land are highly probable to participate in urban farming. The authors further assert that land can be used as a collateral to obtain agricultural loans from banks hence, getting access to it is a motivating factor for a household's participation in urban agriculture.

The findings of Adebese and Monisola (2012) may be criticized for two reasons. Firstly, the study focused only on the determinants of women's participation neglecting factors that motivate males to participate in urban farming. Focusing on factors that motivate both men and women to participate in the activity would have produced results that can be generalized. Thus, the findings of this study may not be generalized as a reflection for the whole population for policy purposes. Secondly, the econometric methodology adopted for analyzing factors that motivate women to participate in urban farming appears inappropriate.

Dossa et al. (2011) examine the association between household socio-economic status and involvement in urban and peri-urban agriculture (UPA) in three West African countries; Nigeria, Mali and Burkina Faso. The findings of their study revealed that household size constitutes a significant determinant of households' participation in UPA. The authors established that irrespective of the country, households involved in UPA had larger household sizes as well as more active members compared to non-practicing households. For instance, in Kano, Nigeria, households that participated in UPA were about 1.1 times larger than non-participating households. The authors argue that the larger the household, the higher the demand and expenditure for food hence, the more likely it is for the household to engage in UPA which provides a means for reducing household expenditure on food. This finding is confirmed by Jongwe (2014) who asserts that an increase in the size of a household raises the household's vulnerability to food insecurity thus, resulting in the household's participation in urban agriculture as a coping strategy.

The findings of Dossa et al. (2011) also revealed that the household head's age is a major determinant of a household's involvement in UPA in Sikasso, Mali. The authors found that the household head's age had a positive effect on household's involvement in UPA; the older the head of the household, the higher the likelihood of the household's involvement in UPA. However, this finding is contradicted by the result of Jongwe (2014).

In Bobo Dioulasso, Burkina Faso, involvement in UPA is significantly and negatively associated with the level of formal education of the household head (Dossa et al. 2011). Households with heads with higher levels of formal education were less likely to participate in UPA as compared to households with less formally educated heads. This finding is confirmed

by Jongwe (2014) who argues that highly educated household heads are more likely to secure good jobs which would pay them better hence, may not require income augmenting.

However, Dossa et al. (2011) discovered no reliable proof of relationship between household's socio-economic status and its involvement in farming activities. This result is in support of the argument that not just the urban poor, but households from all income class participate in urban farming activities (Maxwell, 1995; May & Rogerson, 1995; Mkwambisi et al. 2010). This implies that, urban farming activities is not a reserve for the urban poor seeking to secure an access to food that is not dependent on cash but an activity represented by households of all socioeconomic status. Thus, a household's socioeconomic status does not necessarily constitute a determinant of the household's participation in the phenomenon. Zezza and Tasciotti (2010) on the other hand found that urban agriculture is an activity of the poor.

A logistic regression analysis of the factors that determine a household's participation in urban agriculture in Gweru city, Zimbabwe, revealed that characteristics such as sex, age, educational level and employment status of the household head significantly influence the decision to engage in urban agricultural activities (Jongwe, 2014). The author found that participation in urban farming activities was predominantly by male-headed households. The author argued that, the haphazard nature of plot allocation, and conflicts inherent in urban lands favored participation by males compared to female participation. In addition, the labor-intensive nature of the phenomenon does not encourage female participation.

Jongwe (2014) also found that households that were engaged in urban agriculture had heads who were slightly younger in years than non-participating households in Zimbabwe. According to the author, this is because older households shun urban agriculture due to its labor-intensive

and laborious nature. The author further explains that such older households according to the life-cycle hypothesis might have accumulated sufficient wealth which better cushions them against vulnerability, thus, may not need urban agriculture as a safety net.

Furthermore, participation in urban agriculture seemed to be positively affected by the employment status of the household head (Jongwe, 2014). This is because, households with formally employed heads have better chances of procuring urban agricultural lands to farm and vice versa. Thus, households with formally employed heads were found to be highly probable to engage in urban agriculture compared to households with non-formally employed heads. This finding is a contradiction to the general notion held by many that engagement in urban farming is the preserve of the urban unemployed and underemployed.

In addition, the educational level of the household head negatively affects participation in urban agriculture (Jongwe, 2014). Households with highly educated heads were less likely to participate in urban farming and vice versa. According to the author, this is because, highly educated heads stand a better chance of securing good jobs and thus, would be paid better at their workplaces hence, may not need income augmenting.

Lastly, Jongwe (2014) finds that the push determinants of urban agriculture participation are economic, food security and cultural incentives. Economic factors include cultivation for household consumption, unavailability of food and income enhancement. Furthermore, food insecurity or the household's perceived vulnerability to it constituted a key factor of household's involvement in farming. Due to food insecurity or the perceived risk of it, about 96.2 percent of the total number of respondents engaged in urban farming for household consumption in order to improve their food provisions.

The cultural factors that influence individuals to participate in urban farming include hobby and/or tradition. Here, farmers who had migrated to the urban centers sought to continue their farming activities by participating in urban farming. Also, there seemed to be the influx of the rich who saw participation in urban agricultural activities as a hobby.

Rezai et al. (2014) assess the factors which determine public participation in urban farming in Malaysia. The study finds six underlying factors; economic impacts, social impacts, health impacts, societal recognition, individual's attitude and knowledge as the main determinants of public participation in urban agriculture in Malaysia. The social, health and economic impacts are consistent with past studies (Corrigan, 2011; Kremer and DeLiberty, 2011). The authors found that influences from society such as involvement of loved ones in the phenomenon, development of social interaction etc. placed a high level of importance in the decision to participate in urban agriculture. In addition, the individual's knowledge about urban agriculture and its consequences also significantly determine his/her decision to participate in the activity.

3.4 Urban Agriculture Production Systems

There are many categorizations of urban agriculture production systems in the literature. Some studies have concentrated on particular classifications for instance home-based classifications (Lee-Smith et al. 1987; Chauca, 1999) and open-space systems (del Rosario, 1999; Freeman, 1991; ENDA-ZW, 1997). Home-based production systems are mostly for the cultivation of some crops and vegetables that are meant for the consumption of the household. Also, the home-based system may be used for the rearing of animals. The open-space production system is mostly for the cultivation of cereals such as sorghum and maize or for the production of root tubers such as sweet potatoes.

Other studies have established classifications for specific production systems including animal production (Chauca, 1999; Centres, 1991) and market vegetables production (Abutiate, 1995; Centres, 1991). Kouvonou et al. (1998) and Abutiate (1995) categorized them into three groups based on time devoted to the activity, namely, part-time producers, full time producers and all year round producers. Part-time producers include individuals who are employed in other sectors but engage in farming such as urban night security men. Full time producers are those who are fully employed as farmers and supply their own labor. All year round producers, on the other hand, produce throughout the year and mostly depend on hired labor.

On the other hand, Lourenco-Lindell (1995) classified urban food production according to outputs' destination; subsistence (household consumption) or market oriented. Urban food production for subsistence purposes are mainly for the consumption of the household and mostly on small- scale basis. In Bandim, Lourenco-Lindell (1995) finds that none of the rice produced for subsistence purposes ever gets to the market because, in many instances, the produce is not adequate enough to sell, or even for the household's consumption till the next season. The rice produce (exclusively for subsistence purposes) has five key purposes; household consumption, gifts to relatives and friends, traditional ceremonials, seeds for the next production round and feeding the labor force during the ploughing and harvesting seasons (Lourenco-Lindell, 1995).

Maxwell (1995), Sumberg (1999) and Zakariah et al. (1998) based their classification on a mixture of factors such as time allocation, tenure modality and product destination. In a case study in Kampala, Uganda, Maxwell (1995) found four main categorizations of urban farmers. The first group, termed as the 'commercial farmers' produce basically for the urban market.

This type of production system is specifically for the market and mostly on a large scale. The second group consists mainly of peri-urban households who hold most of their traditional land properties to be categorized in relations to self-sufficiency, though in practice, it is known as 'self-sufficiency in staple foods'. The third group constitutes the largest group of urban farmers in Kampala which consists of households participating in the activity for food security reasons. Farming here is mostly a supplementary source of occupation and food and mostly on small scale basis. The last group mainly consists of women with very low income, either widowed or abandoned by husbands and are faced with restricted economic options. Compared to the 'measure of food security' category which can use all its output, this last group is sometimes compelled to market some of their produce even if the produce is not sufficient for the household in order to obtain other household necessities (Maxwell, 1995).

3.5 Key Participants of Urban Agriculture

There are many participants of urban farming. Zezza and Tasciotti (2010) assert that urban farming is eminently an activity of the poor. In their comparative study consisting of fifteen (15) developing countries, the authors noted a negative relationship between involvement in urban agricultural activities and the level of welfare. In eight (8) out of the fifteen (15) countries studied, participation by the poorest quintile was high (over 50 percent). The authors therefore conclude that urban agriculture provides a means by which the urban poor get access to food and also earn income if there is a surplus to sell. Similarly, Freeman (1991) argues that a considerable amount of the people involved in urban agricultural activities are low-income men and women whose primary objective is for self-consumption and cash income if there is a surplus to sell.

However, these findings are contradicted by the findings of Dossa et al. (2011) who found no reliable evidence of a relationship existing between a household's socio-economic status and its involvement in UPA. The authors established that UPA is not only practiced by the urban poor, but people from all socio-economic groups participate in the phenomenon. The authors found no substantial difference between the participation rate of poorer socio-economic class and that of richer socio-economic class. In light of this, Dossa et al. (2011) argue that UPA is not a livelihood scheme adopted by poor urban residents or new inhabitants especially rural migrants but rather a survival strategy for all urban residents across all socio-economic class.

Maxwell et al. (1998) found that women constituted a substantial percentage of the urban farmer population in Kampala, Uganda. According to these women, farming as compared to other informal activities can easily be undertaken alongside other household chores especially providing more direct care for their children. In their study of Kampala, Maxwell et al. (1998) found that nearly 80 percent of urban agricultural labor were provided by women. Mostly, men were involved in the payment for cash inputs, and the acquisition of agricultural land for food production. In addition, there is evidence of the use of children's labor in urban agricultural activities particularly when the household is female-headed. For instance, Nugent (2000) highlights that women and children mostly cultivate household plots which are in most cases (75 percent) controlled by an adult male in the household in Dakar. These findings are however contradicted by the results of Asomani-Boateng (2002), Danso et al. (2004), Armar-Klemesu and Maxwell (1998) and Jongwe (2014).

Some studies have identified that urban farmers are likely to be migrants from villages or smaller towns and are mostly not new influxes. Mwangi (1995) discovered in a study of three

zones of Nairobi, Kenya that out of the 177 producers, more than 60 percent had migrated to the city before 1985.

In contrast to the claim that urban cultivators are normally migrants from small towns and rural centers where they participated in farming activities, Dossa et al. (2011) found no major difference between the migration status of households participating in UPA and non-participating households. The authors assert that land in urban cities is more likely to be owned by individuals who have been in the city long enough, thus, new migrants may not have easy access to agricultural land in the city. This implies that established urban residents have a higher chance of participating in urban farming activities compared to recent inhabitants. This finding is consistent with the results of some studies such as Sanyal (1986), Sawio (1994) and Freeman (1991).

3.6 Urban Agriculture and Income

Income from urban agricultural activities has been found to contribute significantly to household maintenance (Nugent, 2000). Urban agricultural activities generate principal and/or supplemental revenue, that can be invested in other income-generating opportunities. This income is obtained directly from the sale of output and indirectly from the reduction of the household's expenditure on food. For instance, Staal (1997) found that in Addis Ababa, the profits obtained by smallest-scale backyard cultivators with little investment were above normal profits. Also, cultivating one's own food reduces the household's food expenditures (Sanyal, 1996).

Additionally, Drescher (1999) noted that in Lusaka, although very periodic, an average of three month's earnings was obtained from home gardens. In Dar es Salaam, Tanzania, estimates

show that the production of certain vegetables on a full-time basis or rearing a limited dairy cows and a garden generated an average earnings of US\$60, which was about 30 percent above the average income (Nugent, 2000). Similarly, in Russia, a comprehensive household study revealed that in 1995, urban gardeners in three capital cities and smaller cities obtained an average of 12 percent and 10.6 percent of their incomes from gardening respectively (Seeth et al. 1998 cited in Nugent, 2000).

A household socioeconomic monitoring study carried out by the Environmental Development Activities Agency (ENDA-Zimbabwe) for the 1996-97 season affirms the nutritive benefits and economic significance of urban food production. Urban households that participated in farming activities were in most circumstances better-off compared to non-farming households. Although a marginal one, the urban cultivators obtained a positive net benefit even after the deduction direct input costs. The maximum revenue obtained was equivalent to seven (7) months' wage at the industry minimum wage, while the average incomes were comparable to about two weeks' industrial earnings (ENDA 1996 cited in Nugent, 2000).

Income from urban agricultural activities has been found to be high in emerging economies. Zezza and Tasciotti (2010), in a comparative analysis using data on fifteen (15) developing countries, found that the impact of urban agriculture on the incidence of poverty is more pronounced in the African countries, namely Ghana and Nigeria. The authors discovered that income from agricultural activities forms 30 percent or more of the total household income for about 18 percent to 24 percent of all urban households in the African countries in the sample. Should this finding be a representative of African countries as a whole, one may be driven to conclude that urban farming activities constitute a major source of livelihood for most urban families.

Jongwe (2014) found that urban agriculture contributes indirectly to household income by reducing household expenditure on food in Zimbabwe. The results revealed that the mean food expenditure was significantly lower in urban agriculture participating households as compared to non-participating households. The mean non-food expenditure for urban agriculture participating households were considerably higher than non-participating households (Jongwe, 2014). The author argued that households involved in urban agriculture acquired additional non-food items than non-participating households, largely due to monies saved indirectly from not buying grain and maize meal.

3.7 Urban Agriculture and Employment.

On urban farming as a source of employment, Smit et al. (1996) claim that urban agriculture provides an employment opportunity for about 800 million individuals globally out of which 200 million are market producers, providing employment for 150 million individuals on a permanent basis. Similarly, Armar-Klemesu, (2000) finds that 40% of urban residents in African countries are engaged in some form of agrarian activity. Table 3.1 below shows an estimate of employment in farming activities.

Table 3.1 Employment in Urban and Peri-Urban Agriculture

Place and estimation year.	Percentage share of employment	Aggregate number of jobs.	Wage – Labor employment
Dar es Salaam, 1999		35,000 households	
Shanghai, 1999		3.6 million jobs	
London, 1999	0.04% of work-force	3000 jobs	
Jakarta, 1997	1.0% of work-force	100,000 jobs	92,500 jobs
Sofia, 1999	High, part-time	13,400 jobs	
La Paz, 1997		3970 jobs	
El Alto area, 1997		1975 jobs	
Nairobi, 1999	25% of inhabitants	150,000 households	
Havana, 1999		117,000 ft and pt	30,000
Mexico City, 1999	1-19% of employed		
Accra, 1999	13.6% of sample		

Dakar, 1999		15,000 (official)	
Hubli-Dharwad, 1991	20% of women 11% of men		

Source: Nugent, 2000.

At the national level, some studies have provided estimates for the aggregate economic impacts of urban agriculture. Although, these contributions may not be large, they cannot be overlooked. Table 3.2 below provides an estimate of the economic impacts of urban agricultural activities.

Table 3.2. Economic Impacts of Urban Agriculture

City, Author and year	Income obtained
Lima (case study 1999)	4 percent of the city's GDP in 1995
Shanghai (case study 1999)	2 percent of the city's GDP
Dar es Salaam (Howarth 1996)	\$25 million
Hartford, USA (Nugent 1999a)	\$ 4-10 million, depending on area included
Harare (ENDA-Zimbabwe, 1996)	\$ 5 million from the production of maize
Nairobi (Mazingira 1985)	\$ 4 million

Source: Nugent, 2000.

3.8 Urban Agriculture and Food Security

Recently, studies focusing on urban farming as a tool for enhancing nutrition and food security have gained considerable attention. Studies from countries such as Zimbabwe and Uganda have demonstrated that urban farming significantly enhances food and nutrition security of several major cities. In addition, it is equally a significant part of the urban food structure and an

opportunity for disadvantaged groups and individuals to decrease their vulnerability to food insecurity. The table below shows, for certain cities, the amount of food produced through urban and peri-urban farming

Table 3.3 Food produced through urban and peri-urban agricultural activities (UPA)

City and estimation year.	Proportion of domestic consumption met by UPA	Aggregate annual production (in tons, unless noted)
Havana, 1998		541,000 (vegetables)
Dakar, 1994/95	70 % of vegetables 65-70% of poultry	43,000 (vegetables)
Harare, 1999	small	
Dar es Salaam, 1999	60% of milk 90% of vegetables	
Jakarta, 1999	10% of vegetables 16 % of fruit 2% of rice	
La Paz, 1999	30% of vegetables	
Hubli-Dharwad, 1999	small	40,000 litres/day
London, 1999		8,400 (vegetables)
Ho Chi Minh City, 1999	high	217,000 (rice) 214,000 (vegetables) 8,700 (poultry) 241,000 (sugar) 27,900 (milk) 4,500 (beef)
Sofia, 1999	48% of milk 53% of potatoes 50% of vegetables	

Accra, 1999	1%	
Shanghai, 1999	60% of vegetables 100% of milk 90% of eggs 50% of pork and poultry	

Source: Nugent, (2000)

Studies such as Lourenco-Lindell (1995) and Zakariah et al. (1998) have revealed that urban food production makes available nutritious food which are otherwise unaffordable, substitutes purchased foodstuffs and allows households to save up to 20 percent of the food expenditure. This reduction in household food expenditure implies that the household can acquire additional non-produced foodstuff or can be spent on other needs such as school fees. Households involved in urban agriculture have improved access to cheap proteins (if the household rears animals). In addition, the quality of the household's meal is improved due to the availability of fresh vegetables compared to other similar households. Self-production constitutes about 18 percent (East Jarkarta) to 60 percent (Kampala) of the aggregate consumption requirement of low-income households (Mougeot, 1994). Bowyer-Bower and Drakakis-Smith (1996) discovered in Harare that self-production represents about 60 percent of the total food consumed by low-income groups. Similarly, urban producers in Kampala, Uganda obtained about 40-60 percent of their consumption requirement from their productions (Maxwell and Zziwa, 1992).

Furthermore, case studies of different cities show a significant level of self-reliance in poultry production, supplementary animal by-products as well as fresh vegetables. For instance, Potutan et al. (1999) find that farming households in Cagayan de Oro consume extra vegetables compared to non-farming counterparts within similar income group, and also consume more than households from an upper income group. At the national level, Mbaye and Moustier

(2000) found that about 60 percent of Dakar's vegetable requirement is produced within the city, while its poultry production caters for about 65–70 percent of the aggregate demand requirement. Similarly, urban vegetable cultivation in Accra caters for about 90 percent of the city's requirement of fresh vegetables (CENCOSAD, 1994). More so, Stevenson et al. (1996) found that in Dar-es-Salaam, above 90 percent of vegetables available in the markets were obtained from open space cultivation and home gardens.

In general, researches which have carried out real impact measurements of urban farming on food and nutrition security confirm the notion that urban farming activities contribute significantly to the food security of vulnerable groups. In a case study in Kampala, Maxwell et al. (1998) investigate whether or not urban farming helps in the prevention of malnutrition. The uniqueness of this study emanates from the type of data employed. Prior to their study, previous studies had suggested that urban agriculture positively impacts food security and the nutritional status of vulnerable households in most sub-Saharan countries' cities. However, there had not been any proper examination of any association that exists between semi-subsistence urban farming and the nutritional status of households. This study used primary data on 360 households from a two-round survey in Kampala. The nature of the survey enabled the authors to capture the periodic disparity either through availability of subsistence food, market prices and/or occurrence of illness. The methodology adopted enabled Maxwell et al. (1998) to investigate the factors that determine the nutritional status of children under the age of five years in Kampala, Uganda, where households involved in farming activities constituted one-third of the total sample households.

Maxwell et al. (1998) find that a household's involvement in urban agriculture positively influences its food and nutrition security status. The authors discovered that urban farming has

a significant positive association with the nutritional status of children, especially height for age. Specifically, children aged five years or below from households participating in urban farming were found to be less stunted than those from non-participating households. On the hand, Maxwell and Armar-Klemesu (2000) found no positive relationship in Ghana.

The conceptual framework adopted by Maxwell et al. (1998) suggests two pathways through which this positive relationship is manifested; through enhanced quality and quantity of food consumed and through increased time for direct child care.

A household's participation in urban agricultural activities increases the household's chances of securing a cheaper food source and to a broader range of healthy foods especially vegetables and animal products such as meat and eggs. Furthermore, farming largely allows for additional maternal time for direct child care. This is mainly because the agricultural site is mostly close to the household and also, there is flexibility with regards to the time women go the farm compared to the situation with other vocations. In addition, the positive impacts of urban farming on height for age does not differ considerably at different periods of the year.

In a comparative international perspective, Zezza and Tasciotti (2010) examine the usefulness of urban agriculture to the urban poor and the food insecure. Prior to this study, previous studies on the subject matter were found to be qualitative. Data set for this study was obtained from a dataset created to bring together similar, nationally representative household survey data for fifteen (15) emerging economies. This study adopted two proxies for food security, namely, dietary diversity score and the simple food count.

Using dietary diversity score and simple food count, Zezza and Tasciotti (2010) find that urban household's engagement in farming activities is related to a higher dietary diversity in ten (10) and eleven (11) out of the fifteen (15) countries respectively. Engagement in urban farming was accompanied by 6 to 34 percent rise in the average number of food consumed. Controlling for other factors, Zezza and Tasciotti (2010) highlighted that urban households that participate in farming activities are highly probable in most of the countries to have wide-ranging diets and to consume additional calories. The authors conclude by emphasizing that having a secured source to a wide range of foods particularly vegetables and fruits through urban farming activities may potentially contribute significantly to shielding particularly the urban poor in times of food price hikes that may result from economic crisis.

Jongwe (2014) examines the synergies between urban agriculture and food security in Gweru city, Zimbabwe. In this study, the author uses primary data obtained from a survey of 150 households as the major data source while secondary data are employed to authenticate the primary data collected. The findings of the study revealed that households that participated in urban agricultural activities were more food secure than non-participating households. Non-urban agriculture households ran out of food faster at the beginning, middle and/or end of the month than urban agriculture practicing households during the food crisis in 2008. Most households involved in urban agricultural activities were never short of food during that period (Jongwe, 2014). Also, the mean food expenditure of households participating in urban farming, as Jongwe (2014) found, was considerably less compared to that of non-farming households. This revelation is evidence of the fact that households participating in urban farming produced a significant proportion of the household's food requirement, hence their ability to purchase more of other consumables they could not produce themselves. In addition, urban agriculture

participating households obtained extra non-consumables compared to non-participating households largely as a result of a reduction in their food expenditure.

Mwangi (1995) compares in a case study, agricultural and non-agricultural households in low-income areas in Nairobi, Kenya. The author noted that although the mean consumption for both households were below the average mean, households that engaged in farming were well-off with regards to energy and protein consumption. Farmers who participated in a structured urban agriculture support program as the study found were significantly well-off with regards to their energy and consumption of protein. Farming households produced about 20 to 25 percent of the household food requirement and were considerably less reliant on gifts and transfers. The findings of Mwangi (1995) are in line with that of Sawio (1993) who reported that almost half of 260 inhabitants of Dar es Salaam reported that urban agricultural activities accounted for 20-30 percent of the household's food necessities.

3.9 Relevant Literature on Ghana

Asomani-Boateng (2002) focused on urban cultivation in Accra, Ghana. He found that urban food cultivation is dominated by males. He found that over 80 percent of the respondents (72 out of 87) were males. This finding is consistent with the results of other studies such as; Armar-Klimesu and Maxwell (1998); Danso et al. (2004) and CENCOSAD (1994).

Armar-Klimesu and Maxwell (1998) found that while urban agriculture may be dominated by women in most cities in sub-Saharan Africa, men constitute more than 60 percent of the urban cultivators in Accra. Similarly, Cencosad's study, which mainly concentrated on urban market gardening in the Greater Accra Metropolis found that almost all participants in market gardening are males.

Danso et al. (2004) investigated gender and urban agriculture in Accra, Ghana. Specifically, the authors sought to describe the roles and values of males and females in the production and marketing of vegetable crops in Accra. The authors noted that urban farming in Accra is dominated by males. This, according to the authors, is due to its laborious nature especially land preparation, which is largely labor-intensive. Similarly, Potutan et al. (2000) noted that most of the farming work in Cagayan de Oro city is done by men while women attend to other household chores.

In an attempt to explain the underlying cause for the dominance of males in urban agricultural activities in Accra, Asomani-Boateng (2002) highlights that this pattern reflects the traditional roles of males and females in the Ghanaian culture where women predominantly engage in petty trading activities and men dominate in farming activities. In some Ghanaian communities, women do not farm by themselves but rather support their spouses. Thus, it is rare for a female to cultivate a farm by herself. For instance, Zakariah et al. (1998) report that it is unacceptable for women who hail from the Northern part of Ghana to farm by themselves. This phenomenon may also be explained by the tedious nature of farming. Few women prefer to farm due to its tedious and labor-intensive nature (Danso et al. 2004). Also, most women do not find farming a stable livelihood strategy since it is dependent on the weather and other factors which are characterized by uncertainties. In other words, farming in Ghana is characterized by many uncertainties, hence most women do not find it attractive. Similarly, Armar-Klemesu and Maxwell (1999) in explaining this male dominance phenomenon point out the customary societal behavior, intra-household income behavior and other feminine duties.

Armar-Klemesu and Maxwell (2000) review the impacts of urban agricultural activities on livelihoods, food, and nutrition security in Greater Accra, Ghana. Data for the study is primarily

obtained from a household survey of 559 households in sixteen enumeration areas. The authors discovered that participants of urban agricultural activities were mostly men who constituted more than 60 percent of active participants while a significant proportion of women engaged in the raising of livestock. Also, farming was fairly spread across all income groups implying that farming in urban areas is neither a reservation for the vulnerable urban residents nor new residents. Farming was primarily carried out for three major motives namely, cash earnings, subsistence food and as an asset which can easily be converted into cash during emergencies.

However, Maxwell and Armar-Klemesu (2000) find little evidence of the positive effect of urban farming on food security as found by Maxwell et al. (1998). Only one percent of the household's food requirement is obtained directly from the production of urban agriculture in Accra. Although, Maxwell and Armar-Klemesu (2000) noted specific impacts from case studies with regards to the direct access to food, the overall impact of urban farming activities on household food security was relatively small.

Maxwell and Armar-Klemesu (2000) find no positive relationship between urban agriculture and the children's nutritional status in both a bivariate and multivariate analysis. This revelation contradicts the findings of Maxwell et al. (1998). Maxwell and Armar-Klemesu (2000) noted that the incidence of stunting among children aged five or below was higher in farming households than non-farming households. The authors suggest a set of reasons that may account for the restricted effect of urban farming on household food security and nutrition status. Firstly, the authors noted that few households participate in the activity compared to other African countries' cities. Also, households participating in some form of agriculture employ it as an "asset strategy" which serves as a means of providing those households income through sales in the event of a crisis, or a household's food source at special occasions. In addition, the dominance of urban farming activities by males in Accra makes it difficult to

distinguish income from urban agricultural activities from other incomes sources. Given these reasons, it is not surprising that the impacts of urban farming on consumption is limited.

3.10 Summary

This chapter provided a review of the theoretical and empirical literatures on the determinants and consequences of urban agriculture. The factors influencing a household's decision to participate in urban agriculture included age, gender, educational level and employment status of the household head. The available empirical literatures provide evidence in support of the various motives for urban agriculture – food and nutrition security (Maxwell et al. 1995; Jongwe, 2014; Zezza and Tasciotti, 2010); income (Jongwe, 2014) thus contributing to household welfare. Urban agriculture clearly contributes significantly to the self-reliance of many major cities especially those in Africa. As reiterated by Mougeot (1994), although food self-reliance is not self-sufficiency, it significantly enhances the food security of vulnerable groups.



CHAPTER FOUR

METHODOLOGY AND DATA

4.0 Introduction

This chapter presents a discussion of the methodology adopted and the data employed in this study. Specifically, the chapter provides a definition of urban agriculture and a discussion of the theoretical framework employed in the analysis. In addition, the econometric specifications and the estimation procedures adopted to empirically assess the determinants and welfare consequences of urban agriculture in Ghana as well as a brief discussion of the data and variables are presented.

4.1 Definition of Urban Agriculture

A common difficulty with studies on urban agriculture is the lack of clarity on the definition of the phenomenon. Mougeot (2000) highlights that most authors define urban agriculture only in general terms and that, these studies hardly use their results to improve the urban agricultural concept and to clarify its distinctiveness. The absence of a universally accepted definition of urban agriculture makes comparison among these studies quite unclear and problematic. Furthermore, this absence of a universal definition makes the assessment of the welfare impacts of urban agricultural activities empirically difficult.

Mougeot (2000) stresses that efforts to define urban agriculture should bear purpose and that, the concept should have a distinct construction, both on content and form and change through its interaction with the development of interrelated concepts. The author further highlights that urban farming is integrated into the local urban economic and ecological system. Thus, the urban agriculture concept will be of little use on the scientific and policy fronts if this aspect is not emphasized and made operational. In light of this, it is not necessarily the urban location

that differentiates urban farming from rural farming but the fact that it is integrated into and interacting with the urban ecosystem (Richter et al. (1995) cited in Mougeot, 2000). This integration with the ecosystem is however not in most definitions of the urban agricultural concept.

Mougeot (2005) defines urban agriculture as ‘an industry which is located within (intra-urban) or on the fringe (peri-urban) of a town, city or a metropolis which cultivates and raises, processes and distributes a variety of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban center, and in turn supplying human and material resources, products and services largely to that area.’

In an attempt to define urban agriculture, few authors have contrasted urban and rural agriculture (Binns and Lynch, 1998 cited in Mougeot, 2000). For instance, Moustier (1998) describes urban agriculture as one that takes place within or on city peripheries where a non-agricultural usage of local resources is real option; rural farming takes place in areas where this option is not a problem. Similarly, Mbiba (1995) defines urban agriculture as farming which takes place on land parcels which are legally and administratively allocated for urban purposes. The definition of Smit et al. (2001) however stresses the recycling of urban wastes and the catering for the daily demand.

In a survey of urban agriculture definitions, five elements were found to be present; location in which the activity occurs; type of activities included under urban agriculture; the legality and type of land tenure under which the urban agricultural activities occur; the stages of production included in urban agriculture; and the scale of urban agricultural activities (Quon, 1999 cited in Smit et al. 2001).

This study adopts a definition of urban agriculture that is similar to the definition proposed by Zezza and Tasciotti (2010) such that urban agriculture does not necessarily depend on the location of the activity but rather the location of the household. For the purpose of this study, urban agriculture is defined as the production of agricultural goods by urban residents according to the official definition of the urban space utilized by the survey data employed in this study. This definition is necessitated by the fact that the survey data employed in this study does not capture information on the location of the activity but rather capture information on where the household resides. In light of this, urban agriculture here is strictly “agriculture practiced by urban residents”. In this study, an urban agriculture household is a household in which at least one member of the household is involved in agriculture.

4.2 Theoretical Conceptualization of Urban Agriculture

This study adapts the conceptual framework for urban agriculture and urban households by Kutiwa et al. (2010). Figure 4.1 demonstrates how urban agriculture improves the livelihood of vulnerable urban households. A significant proportion of urban households are poor and food insecure. These households can participate in urban agriculture which has the potential of providing income for the household in addition to addressing three components of food security: food access, food availability and food utilization. Urban agriculture promotes the consistent supply of fresh food especially vegetables and dairy products. Urban agricultural households are thus able to obtain a significant share of their food requirement and income through the sale of surplus. With the income, these households are able to access appropriate foods for nutritious meals thus improving their welfare.

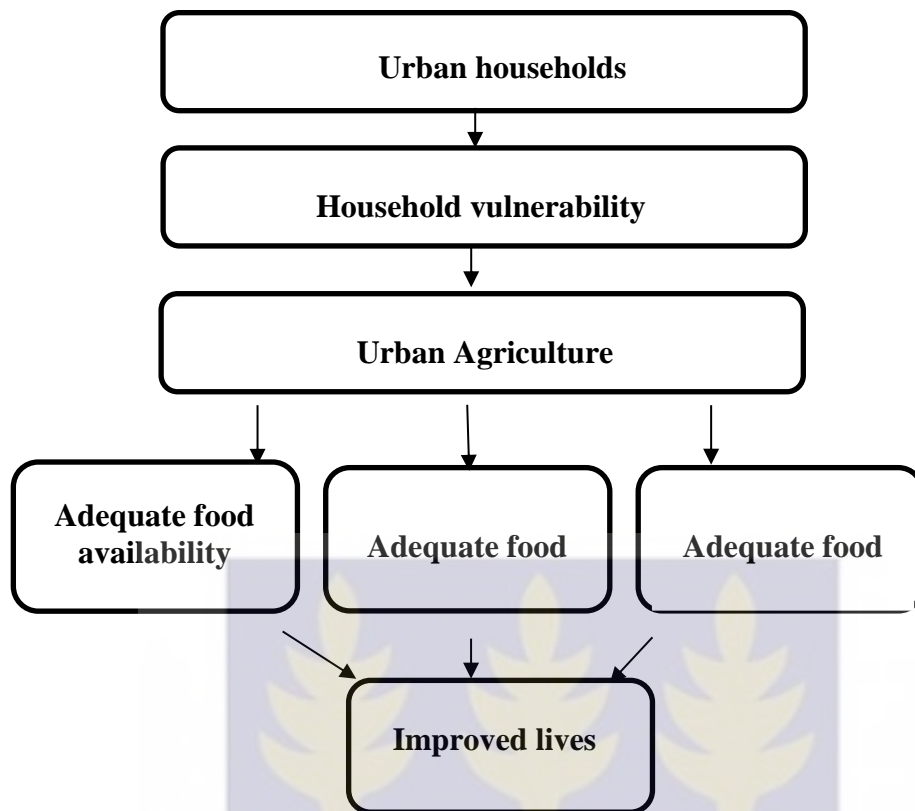


Figure 4.1 Theoretical Conceptualization for Urban Agriculture

4.3 Estimation Specification and Procedure

4.3.1 Modelling Factors Influencing Urban Household’s Participation in Agriculture

Different authors have used varied approaches in estimating the factors that determine urban households’ participation in agricultural activities. To analyze the factors determining urban agriculture participation, Jongwe (2014) employed a logit model whereas Adebisi and Monisola (2012) employed the Stepwise Multiple Regression model. Dossa et al. (2011) also employed a logit model to examine the determinants of urban agriculture decision of urban households in three West African countries.

Based on the framework above and empirical literature reviewed, the following logistic regression model is specified to analyze factors affecting Ghanaian urban households' participation in agricultural activities:

$$Y_i = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Male} + \beta_3 \text{HHsize} + \beta_4 \text{Educ} + \beta_5 \text{Emp_stat} + \beta_6 \text{HHinc} + \beta_7 \text{Landown} \\ + \beta_8 \text{HHmarst} + \beta_9 \text{poor} + \beta_{10} \text{Nfpart} + e_i$$

Where β_0 is a constant, $\beta_1 \dots, \beta_{10}$ are coefficients and e_i is the error term.

Table 4.1 Definition and Measurement of variables used

<u>List of Variables</u>	<u>Definition and Measurement of Variables</u>
Household Head Characteristics	
Age	Age of household head in years
Male	Gender of Household head (Male = 1; Female = 0)
HHsize	Household Size (Continuous)
Educ	Household head's Level of Formal Education (0 = None; 1 = Basic; 2 = Secondary; 3 = Voc/Tech, 4 = Postsec.
Emp_stat	Employment Status of household head
HHinc	Total Household Income (Continuous)
Landowned	Household Accessibility to Land (1 = Access; 0 = No Access)
HHmarst	Marital status of household head
Poor	Household poverty status (1 = poor, 0 = non poor)
Nfpart	Household participation in non-farm activities (1= yes, 0 = no)

4.4 Description of Variables

4.4.1 Dependent Variables

Urban Agricultural Household. An urban household is classified as participating in agricultural activities if at least one adult member (aged 15 to 70 years) of the household is engaged in crop cultivation, livestock rearing and/or fish farming. Here, the dependent variable is binary where:

$Y_i = 1$ if household participates in urban agriculture

$Y_i = 0$ if household is a non-participant.

Real Household Consumption Expenditure per Capita per Adult Equivalent. This is the adult equivalent of real consumption expenditure per capita for each household member. This is used as an indicator for household welfare because consumption has been identified as a more reliable indicator of household well-being than income (Chang 2012). Studies such as Slesnick 1994; and Cutler and Katz (1992) have made the significance of consumption in terms of being a better proxy for welfare to be understood in different ways. Firstly, households and individuals generally do not spend only the current year's earnings but rather what they can afford over the long run. Therefore, household expenditure reflects current income, savings and expected future income. In addition, income varies more than consumption due to borrowing in bad years and saving in favorable years. Furthermore, although statistics may indicate worsening conditions of living of the household, some scholars question whether the distribution of the household's material wellbeing can be effectively captured by such income data (Jencks, 1984 cited in Chang, 2012). In light of this, Cutler and Katz (1992) argue that it is not the income itself but rather, the goods and services that individuals purchase with income that provide life satisfaction. Lastly, income is mostly under-reported and income reported for

farming households can be highly unstable (Deaton 1997 cited in Chang 2012). Thus, consumption may be a better indicator of welfare, particularly for agricultural households.

4.4.2 Independent Variables

Age

The significance of the age of the household head with regards to the household's involvement in urban agricultural activities is very prominent in the literature. It is a form of human capital, although it may not be alterable especially when it is not captured in aggregates (Gordon and Craig 2001). Dossa et al. (2011) reveal that age affects urban households' participation in agricultural activities, with older households being more likely to participate in the activity. On the contrary, Jongwe (2014) finds that in Zimbabwe, urban agricultural households are headed by slightly younger heads than non-urban agricultural households. Owing to the labor-intensive and laborious nature of urban farming activities, most older households may ignore it. In addition, older households may not need urban agriculture as a safety net since the life cycle theory suggests that older households may be better prepared against vulnerabilities than younger households since they might have accumulated assets.

Level of Education

Education as a means of human capital endowment constitutes an important determinant of urban households' participation in agricultural activities. In most instances, households that are headed by individuals with higher attainments of formal education are less probable to engage in urban farming activities as compared to households with less formally educated heads (Dossa et al. 2011 and Jongwe 2014). Such households are more likely to secure better jobs, thus may not need urban agriculture as an income augmenting strategy. Higher educational

attainment leads to higher incomes in four main ways as explained by Gordon and Craig (2001). Firstly, higher attainment of education results in the achievement of valuable skills necessary for success. In addition, higher levels of education instill training processes resulting in confidence building and also offering opportunities to establish important associates and engage in productive investments. Furthermore, education is positively associated with existing wealth and also increases the possibility of an individual in securing higher income jobs. Lastly, education plays a latent role where the highly educated have a higher probability of offering productive advice to the low and/or uneducated household members.

Gender

There is a universal agreement in the literature that gender constitutes an important determinant of participation in urban agricultural activities. A significant proportion of the poor in sub-Saharan Africa are women who are willing to work to secure their families' food security and also to supplement their husbands' incomes.

Maxwell et al. (1998) find in Kampala that women constitute a larger proportion of the participants of urban farming activities as compared to other informal activities. In addition to the improvement in their household food security status and obtaining income to supplement their husband's income, urban agriculture affords them the opportunity to easily take care of other household chores such as providing more direct care for their children.

On the other hand, Jongwe (2014) finds that participation in urban farming activities is dominated by male-headed households in Zimbabwe. The haphazard nature of urban plot allocation, conflicts inherent in urban lands as well as the labor-intensive nature of urban

farming activities favor male participation in the phenomenon. Urban agriculture in Ghana is dominated by males (Armar-Klemesu and Maxwell (1998); Danso et al. (2004) and CENCOSAD (1994)).

Household Size

Household refers to a person or a group of related or unrelated persons who live together in the same dwelling and also share housekeeping and cooking arrangements and are considered as one unit, who acknowledge an adult male or female as the head. A larger household size implies a higher demand and expenditure for food, thus a greater probability of participating in urban agricultural activities. Larger households are highly probable to participate in urban agricultural activities because it provides an opportunity for the household to reduce its expenditure on food (Dossa et al. 2011). An increase in the household size raises the household's vulnerability to food insecurity thus, resulting in the household's participation in urban agriculture as a coping strategy (Jongwe 2014). On the other hand, it can be argued that larger households are highly probable to participate in agricultural activities due to their increased ability to supply labor for the farm work.

Access to Land.

Access to land constitutes an essential determinant of an urban household's involvement in agricultural activities. Households that have easy access to land are more likely to participate in urban agricultural activities and vice-versa (Adebesi and Monisola, 2012). In addition, land can be used as a collateral by farmers to obtain agricultural loans from banks hence, getting access to it is a motivating factor for a household's participation in urban agriculture.

Employment Status.

The employment status of the household head constitutes a vital determinant of urban household's participation in agricultural activities. There is a general notion that participation in urban farming activities is the reserve for the urban unemployed and underemployed. This implies that households that are formally employed are less likely to participate in farming activities since they may be paid better and may not require any income augmenting. Jongwe (2014) however finds in Zimbabwe that participation in urban agricultural activities is dominated by the formally employed households. According to the author, these formally-employed heads stand a better chance of acquiring urban agricultural plots to farm and vice versa.

Household Income.

Most households engage in urban farming activities as a result of income that will be obtained. This income can be obtained directly from the sale of farm produce and indirectly from the reduction of expenditure on food. Thus, urban agriculture provides a safety net for the poor and for households seeking to augment their dwindling incomes (Hovorka et al. 2009). Most studies have concluded that urban agriculture is dominated by the urban poor seeking to secure some source of income (Zezza and Tasciotti, 2010). However, there are contentions that not only the urban poor, but also, households from all socioeconomic groups participate in urban farming activities (Dossa et al. 2011; Maxwell 1995; Rogerson and May, 1995; Mkwambisi et al. 2010).

4.5 Estimation Technique for the Impact Analysis

Here, the principal research question to be answered is;

1. What is the impact of urban agriculture on the participating household's welfare in Ghana?

It can be realized that a common feature of the principal research question is impact evaluation. In other words, the focus of this question is examining the household's welfare implication of urban agriculture. Broadly, the term 'impact' refers to social, economic and environmental effects resulting from the adoption of a given intervention. Impact analysis is an attempt to determine whether an intervention had the desired outcomes on the individual, household, and institution and whether those outcomes are as a result of the programme of intervention. It is important to note here that establishing a counterfactual is very central to the impact evaluation approach. A counterfactual is a hypothetical scenario of what the situation would have been in the absence of the activity.

Broadly, the methods for evaluating impacts are categorized into two namely, experimental (randomized) and non-experimental (non-randomized). Experimental methods are mostly used in evaluations in which participation is randomly determined or where the researcher has control over participation. Here, a control group is randomly selected prior to the intervention or at the onset of the activity and this group is excluded from the activity (World Bank 2007). This approach cannot be employed in this study since urban households' participation in agriculture is neither influenced by the researcher nor random.

Non-experimental methods comprise a variety of techniques that aid in comparison with treatment group. These techniques include difference-in-differences, propensity score matching, selectivity-adjusted modelling and reflexive comparison approaches.

To analyze the impacts of urban agriculture on the household welfare status, we start from the linear equation

$$Y_i = \alpha_0 + \alpha_1 UA + \alpha_2 X_i + e_i$$

Where, Y_i is the outcome variable, household welfare status measured by the real per capita consumption expenditure per adult equivalent.

X_i is vector household characteristics

UA is a dummy, representing 1 if household participates in urban agricultural activities and 0 if otherwise.

e_i is the random error term

In the equation above, participation in urban agriculture is treated as an exogenous variable on the assumption that urban households engage in agriculture to improve their welfare status. This however, may necessarily not be the situation since some urban households may be better disposed to engage in the phenomenon. Furthermore, the decision to participate in the activity may also depend on the benefits from participation itself. This implies that involvement in the activity may not be random, hence the presence of selection bias. Selection bias occurs when unobservable features affect the error terms of the selection and outcome equations, resulting in correlation between the error terms. Consequently, estimating the above equation with the ordinary least squares method may lead to biased estimates.

Several approaches have been employed in impact evaluations or assessments to address selection bias. Amongst them are: difference-in-differences (Abadie 2005), instrumental variable (IV) approach (Abadie 2003), the Heckman Two-Stage approach etc. The Heckman

Two-Stage approach is dependent on the restrictive assumptions of normally distributed standard error terms. Using the IV approach on the other hand, it may be difficult to identify instruments. Furthermore, these approaches tend to impose a linear functional form assumption which may imply that coefficients on control variables may be similar for both participants and non-participants (Abdulai et al. 2011). However, this assumption may not hold since the coefficients could vary.

In view of these limitations, this study adopts the propensity score matching (PSM) technique. The PSM approach involves no assumptions about the functional form in specifying the association between outcomes and the predictors. To address the problem of selection bias associated with participation in urban agriculture, matching techniques are employed in assessing the impacts of urban agriculture on household welfare status.

Moreover, in PSM, attention is concentrated on the region of common support where non-participants with a score lesser than any participant are exempted. On the hand, the regression approaches employed in most literatures use the whole sample and it is argued that estimates based on full unmatched samples are generally more biased and robust to misspecification of the regression function than those based on matched samples (Rubin and Thomas, 2000).

4.6 Specification of the Empirical Model

4.6.1 The Propensity Score

Rosenbaum and Rubin (1983) define the propensity score as the conditional probability of participating in a programme given pre-participation characteristics. For the purpose of this

study, the propensity score $p(Z_i)$ is defined as the conditional probability of urban households participating in agricultural activities given pre-participation characteristics:

$$p(Z_i) = \Pr[(UA)_i = 1 \mid Z_i] = E[(UA)_i \mid Z_i]; \quad p(Z_i) = F\{h(Z_i)\}$$

Where; $(UA)_i = (1, 0)$ is a binary variable indicating whether an urban household participates in agricultural activities (1) or not (0), Z_i is a vector of pre-participation characteristics and $F\{ \cdot \}$ can be a normal or logistic cumulative distribution.

In an attempt to generate a counterfactual, the PSM approach matches each participant with a similar non-participant. This is achieved by identifying the essential characteristics for the decision to participate in the activity, and using these to predict the participating probability for both participants and non-participants. The propensity score, according to Faltermeier and Abdulai (2009) can be predicted with either the probit or logit model. This predicted propensity score is then used to evaluate the treatment effects. The most common treatment effects found in literatures are the Average Treatment Effect (ATE), Average Treatment effect on the Treatment group (ATT) and Average Treatment effect for the Untreated (ATU). The ATE captures the treatment effect for the whole sample; ATT captures the treatment effect on those who participate in the activity; and ATU captures the treatment effects on non-participants. Becker and Ichino (2002) highlight that the ATT is the parameter of interest in the estimation of the propensity score.

Given $p(Z_i)$, the three effects are evaluated as;

$$ATE = E[E\{Y_i^* \mid (UA)_i = 1, p(Z_i)\} - E\{Y_i \mid (UA)_i = 0, p(Z_i)\}]$$

$$ATT = E[E\{Y_i^* \mid (UA)_i = 1, p(Z_i)\} - E\{Y_i \mid (UA)_i = 0, p(Z_i)\} \mid (UA)_i = 1]$$

$$ATU = E[E\{Y_i^* \mid (UA)_i = 1, p(Z_i)\} - E\{Y_i \mid (UA)_i = 0, p(Z_i)\} \mid (UA)_i = 0]$$

Where: Y_i^* is the counterfactual outcome of participation in urban agriculture.

Y_i is the counterfactual outcome of non-participation in urban agriculture.

4.7 Matching Techniques.

There are several matching algorithms suggested in literatures that can be used to match participants and non-participants of similar propensity score. Amongst them are radius matching, nearest neighbor matching, kernel matching and caliper matching methods.

With the nearest neighbor matching technique, each participant is matched to the closest non-participant neighbor with similar observed characteristics. This is carried out with or without replacement. Here, an untreated individual can be used more than once as a match in matching with replacement whilst an untreated individual can be considered only once in matching without replacement. There is a reduction in bias when matching is done with replacement because each participant is matched to the nearest comparison group resulting from a reduction in the propensity score distance. In matching without replacement, a researcher may be forced to match treated individuals or unit to comparison units that may be quite different with regards to the estimated propensity score, resulting in increased biasedness. However, this could improve the precision of the estimates (Dehejia and Wahba, 2001).

Kernel matching technique matches each participant to more non-participants. This results in a reduction in the variance but possibly increasing the bias. Here, the outcome of each treated person is compared to a weighted average of the outcomes of all the untreated persons, with the highest weight being placed on those with scores closest to the treated individual.

The caliper matching uses the nearest neighbor within each maximum propensity score distance. This technique uses all of the comparison units within a pre-defined propensity score radius (or ‘caliper’). An advantage of the caliper matching technique is that it uses only as many comparison units as are available within the calipers, allowing for the use of extra (fewer) units when good matches are (not) available (Dehejia and Wahba, 2002).

In order to ensure the robust estimation of the propensity score, it is imperative that the balancing and the conditional assumptions are satisfied. The balancing assumption implies that conditional on the propensity score, each urban household should have the same likelihood of engaging in agricultural activities as in a randomized experiment. That is, for the balancing property to be satisfied, the distribution Z_i is expected to be balanced (Hujer et al. 2004).

The Conditional Independence Assumption (CIA) on the other hand states that, once the set of observable characteristics, Z_i , are controlled for, the treatment variable (that is participation in urban agricultural activities), and the outcome variable (household welfare) should be uncorrelated.



Rosenbaum and Rubin (1985) propose a standardize bias approach to ensure the quality of matches. This is achieved by carrying out a comparison of condition before and after the matching to verify if any changes have occurred after conditioning on the propensity score.

Another recommendation by Sianesi (2004) is to carry out an additional assessment of the quality of the matching which involves re-estimating the p-score of matched participants and

matched non-participants. The covariates are balanced very well by the matching procedure if the pseudo- R^2 is fairly low after matching, whilst the probability of the F-statistics is not significantly different from zero. A possible hidden bias may occur if there are unobserved variables that influence both household welfare and urban households' participation in agricultural activities. Since it may not be possible to evaluate the degree of selection bias with non-experimental data, Rosenbaum (2002) suggests the use of the bounding approach to assess the influence of unmeasured variables on the selection process. Heckman et al. (1999) highlight a further requirement which is the common support or overlap condition. This requires that households with the same covariates (Z values) have a positive probability of being both participants and non-participants of urban agriculture.

4.8 Data Source

Data for this study was obtained from the sixth round of the Ghana Living Standards Survey (GLSS 6) conducted in 2012/13. The GLSS is a nationwide household survey designed to generate information on living conditions in the country at the individual, household and community levels. The datasets are enormously advantageous for examining various facets of livelihoods in Ghana. Six rounds of the Ghana Living Standards Survey have been completed up to date with each round covering a nationally representative sample of households spread over a period of twelve months. The GLSS 6 covers a sample of 18,000 households in 1200 enumeration areas. Out of the 7445 urban households covered in this survey, 2265 households participate in agricultural activities. The datasets contain detailed information on demographic characteristics of households, education, employment, household agriculture, household expenditure etc.

4.9 Summary

This chapter concentrated on the methodology and data for this study. The chapter further highlighted a definition of urban agriculture, theoretical conceptualization, the models and procedures for empirical estimation and the data source as well as a description of the variables adopted for the study. The study employs the propensity score matching (PSM) approach in examining the impacts of urban agriculture on household welfare. Different econometric models and estimation procedures are employed to achieve the objectives set up in this study.



CHAPTER FIVE

ANALYSIS AND DISCUSSION

5.0 Introduction

This chapter presents and discusses the results of the econometric estimations of this study. The chapter is divided into three sections. The first section provides a summary descriptive of participants and non-participants of urban agriculture. The second part discusses the determinants of urban households' decisions to participate in agricultural activities. The last section discusses the findings of the estimation of the Propensity Score Matching (PSM). The nearest neighbor and kernel matching algorithms are employed in the estimations.

5.1 Summary Descriptive Statistics of Participants and Non-Participants of Urban Agriculture

The table below (Table 5.1) presents a summary of the characteristics of urban agriculture practicing and non-practicing households. The results indicate that there exist some differences between participants and non-participants with regards to the outcome and explanatory variables.

From Table 5.1, the mean age, gender, marital and employment status significantly differ between participants and non-participants. Also, the mean household size, educational attainment, ownership of agricultural land and household poverty status vary statistically between participants and non-participants, which may imply the significance of these determinants of participation in urban agriculture. With regards to the outcome variable, household welfare, there is a statistically significant difference between the means for participants and non-participants.

Table 5.1 Summary Descriptive Statistics of Participants and Non-Participants.

Variable names	Variable definition	Participants		Non-participants		Diff. in means
		N=2249 (30.94%)		N=5109 (69.06%)		
		Mean	S.E	Mean	S.E	
Treatment Var.						
Participation	1=Yes, 0=No					
Outcome Var.						
welfare	Per adult equivalent real consumption expenditure	3387.44	64.86	4834.34	59.41	-1446.89***
Independent Var.						
age	Age of HHH	48.81	0.31	41.89	0.21	6.92***
male	Gender of HHH	0.73	0.01	0.63	0.01	0.10***
hhmarst	Mar. Stat. of HHH	2.11	0.01	1.97	0.01	0.14***
educ	Educ. Att. of HHH	0.66	0.02	0.93	0.01	-0.28***
emp_stat	Emp. Stat. of HH	1.08	0.01	1.17	0.01	-0.09***
hhsiz	Household size	4.59	0.06	3.28	0.03	1.32***
hhinc	HH income	10193.04	592.10	8809.01	326.60	1384.03
poor	HH poverty status (1=poor, 0=non-poor)	0.16	0.008	0.05	0.003	0.10***
landowned	Ownership if agric. Land (1=Yes, 0=No)	0.17	0.01	0.003	0.001	0.15***
nfpart	Non-farm participation (1=Yes, 0=No)	0.51	0.01	0.512	0.01	0.002

Note: Diff= mean (1) – mean (0) **Source:** Author's estimation based on GLSS6

5.2 Determinants of Urban Agriculture Participation in Ghana

To examine the factors that influence an urban household's decision to participate in agricultural activities, a logit regression model was employed. The outcomes of the estimation are shown in Table 5.2 below. In addition, Table 5.2 also presents the marginal effects of the

logistic regression model estimating the probability of the household to participate in urban agricultural activities. The results indicate that the decision to engage in urban agricultural activities is influenced by the characteristics of the household as well as that of the household head.

Characteristics of the household head such as age, gender, employment and educational status significantly affect the household's decision to partake in urban agricultural activities. The results indicate that urban agricultural households are mostly male-headed households. A household headed by a male is highly probable to participate in urban agricultural activities compared to female-headed households. From the marginal effects estimates, male headship increases the probability of the household participating in urban agriculture by about 10.4 percentage points. This result is consistent with that of Jongwe (2014), Danso et al. (2004), Asomani-Boateng (2002) and Armar-Klemesu and Maxwell (1998). Jongwe (2014) asserts that the disorganized nature of plot allocation and conflicts inherent in urban lands as well as the laborious nature of urban farming favors participation by males compared to female participation. Asomani-Boateng (2002) attributes the dominance of males in urban agricultural activities to the traditional norms and culture of the Ghanaian society.

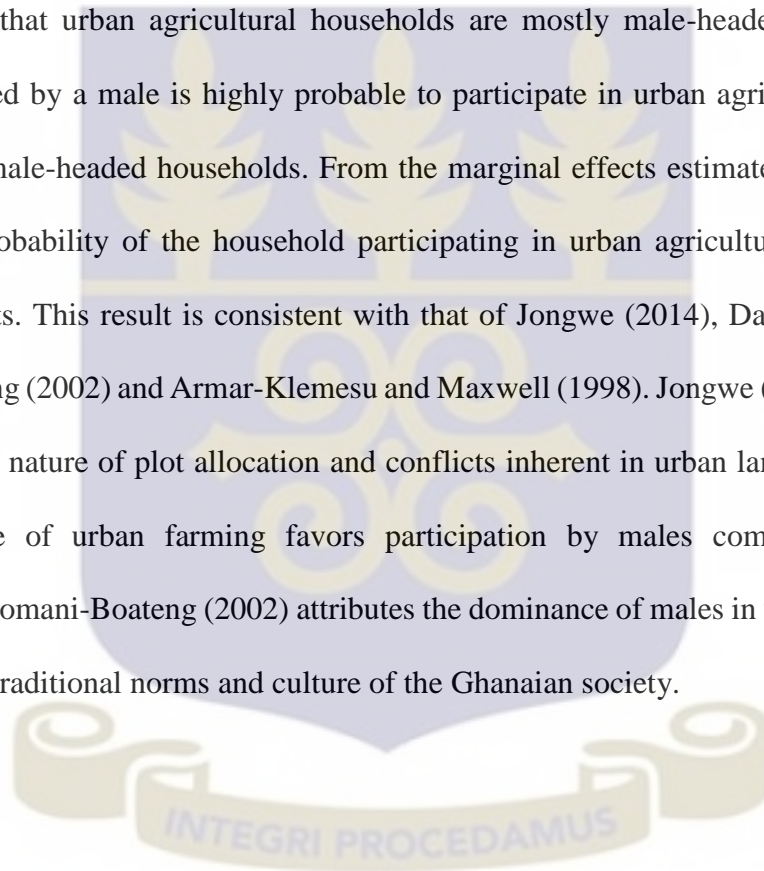


Table 5.2 Marginal Effects of the Logistic Regression Estimating the Probability that a Household Participates in Urban Agriculture in Ghana.

Variable	Coef.	Std.Err	P>Z	Marginal Effects	Std.Err
<i>X'tics of HH</i>					
Age	0.067***	0.014	0.000	0.012	0.002
<i>Gender</i>					
Male(<i>Dummy</i>)	0.615***	0.089	0.000	0.104	0.014
<i>Educ. Attainment</i>					
<i>No Educ. (Ref. Cat.)</i>					
Basic	-0.458 ***	0.076	0.000	-0.081	0.013
Secondary	-1.336***	0.113	0.000	-0.184	0.012
Voctech	0.307	0.297	0.302	0.059	0.061
Postsec	0.480	1.252	0.701	0.096	0.276
<i>Employment Status</i>					
<i>Employed (Ref. Cat.)</i>					
Retired	-1.269***	0.270	0.000	-0.156	0.021
Unemployed	-1.526***	0.136	0.000	-0.190	0.012
<i>Marital Status</i>					
<i>Married (Ref. Cat.)</i>					
NotMarried	-0.077	0.105	0.461	-0.014	0.018
Divorced or Widowed	-0.093	0.102	0.365	-0.061	0.018
<i>Household X'tics</i>					
hhsiz	0.15***	0.015	0.000	0.030	0.003
<i>Poverty status</i>					
Poor (<i>Dummy</i>)	0.166	0.112	0.137	0.031	0.021
<i>Ownership of Agric. Land</i>					
Landowned (<i>Dummy</i>)	3.813***	0.295	0.000	0.719	0.023
<i>Non-farm Part.</i>					
nfpart	-0.552***	0.070	0.000	-0.099	0.013
<i>Household Income</i>					
lnhhinc	0.050**	0.024	0.041	0.009	0.004
<i>Region</i>					
<i>g_accra (Ref. Cat.)</i>					
western	2.090***	0.157	0.000	0.468	0.033

central	2.145***	0.156	0.000	0.480	0.032
volta	3.022***	0.161	0.000	0.637	0.023
eastern	2.975***	0.150	0.000	0.632	0.023
ashanti	1.550***	0.150	0.000	0.336	0.034
b_ahafo	3.072***	0.166	0.000	0.629	0.022
northern	2.964***	0.164	0.000	0.627	0.024
u_east	3.378***	0.185	0.000	0.679	0.021
u_west	2.949***	0.202	0.000	0.620	0.028
Constant	-6.087***	0.407	0.000		
<hr/>					
Log Likelihood			-3588.9917		
Pseudo R2			0.2152		
P > chi2			0.0000		

***Significant at 1% **Significant at 5% *Significant at 10%

Source: Author's estimation based on 2012/13 GLSS Data

Similar to the finding of Jongwe (2014), the educational attainment of the head of the urban household has a negative effect on the household's participation decision. In comparison with urban household heads with no formal education, urban household heads with basic and secondary educational attainment are less likely to participate in agricultural activities. This finding also confirms the finding of Dossa et al. (2011) for sample households in Bobo Dioulasso, Burkina Faso. The marginal effects results indicate that compared to household heads with no formal education, the probability of participating in urban agricultural activities by household heads with basic and secondary education are reduced by about 8.1 and 18.4 percentage points respectively. This negative relationship between educational attainment and participation in urban farming activities may be taken as an indication that households with formally educated heads stand a better chance of securing good jobs and thus, would be paid better at their workplaces hence, may not need income augmenting through participation in urban agricultural activities.

The age of the head of the household is positively related to an urban household's decision to participate in agricultural activities. This means that households with older heads are more likely to participate in farming activities. From the analysis, a one-year increase in the household head's age raises the household's likelihood of participating in the phenomenon by about 1.2 percentage points. This result is consistent with that of Dossa et al. (2011) who find that urban households engaging in agricultural activities in Sikasso, Mali have older heads compared to non-participating households.

The size of the household constitutes a significant determinant of the household's decision to partake in urban farming activities. The results indicate a positive relationship between household size and participation in urban agricultural activities. This implies that households that have more members are more likely to engage in urban farming activities. In other words, urban agricultural households on the average are larger than non-urban agriculture participating households. A rise in the size of the household by one person raises the household's probability of participating in urban agriculture by about 3 percentage points. This finding confirms that of Dossa et al. (2011) who argue that larger households have higher food expenditure thus, they are more probable to engage in urban agricultural activities as a means of reducing their expenditure on food as well as improving their access to nutritious foods. Similarly, Jongwe (2014) argues that larger households are more vulnerable to food insecurity, thus employing urban agriculture as a coping strategy.

An urban household's access to land significantly influences its decision to engage in the phenomenon. The results indicate a positive association between access to land and the decision to participate. This finding is consistent with that of Adebisi and Monisola (2012). Land constitutes one of the significant factors of farming. Thus, households that have easy

access to it are more likely to participate compared to households with limited or no access. Furthermore, it can be observed that compared to the Greater Accra region, urban households in the other regions are more probable to engage in urban agricultural activities. This may be attributed to the availability of land and/or the ease of acquiring land in these other regions.

From Table 5.2, the results reveal no significant relationship between the poverty status of an urban household and its decision to participate in urban agricultural activities. This suggests that, the household's decision to engage in farming activities is not influenced by whether the household is poor or not. This result could be a reflection that urban agriculture is not an activity of the urban poor seeking to obtain a secure access to nutritious food that is not dependent on income. Thus, the decision to participate in urban farming activities may not be influenced by the household's socio-economic status. Therefore, this finding is in support of the argument that not just the urban poor, but households from all socio-economic groups participate in urban farming activities (Dossa et al. (2011); Maxwell et al. (1995) and Rogerson and May (1995)). However, the results reveal a positive association between household income and the decision to participate in urban farming activities at 5 percent significance level.

The results indicate a significant association between the employment status of the head of the household and the decision to participate in urban agriculture. Compared to household heads who are employed, household heads who are retired and unemployed are less likely to participate in urban agricultural activities.

There is a negative relationship between participation in non-farm activities and participation in urban agriculture. This implies that households that participate in non-farm activities are less

likely to participate in urban agriculture. From table 5.2, households that are engaged in non-farm activities are about 9.9 percent less probable to engage in urban agricultural activities.

Lastly, the results reveal no significant association between the marital status of the head of the household and the decision to engage in farming activities. Thus, the decision to participate in urban farming activities is not influenced by whether the household head is married, divorced or widowed.

5.3 Propensity Score Matching Results

A logistic regression model was employed in the computation of the propensity scores. According to Owusu et al. (2011), the propensity score serves as a means for balancing the observed distribution of covariates across the treated (i.e. participants of urban agriculture) and the untreated (non-participants) groups. The study employed the `psmatch2` and `att*` approaches by Leuven and Sianesi (2003) and Becker and Ichino (2002) respectively to estimate the treatment effects.

The distribution of propensity scores after matching as shown in figure 5.1 below confirms that the estimation of the p-score effectively balances the participant and the non-participant groups. This result highlights the significance of the propensity score matching approach.

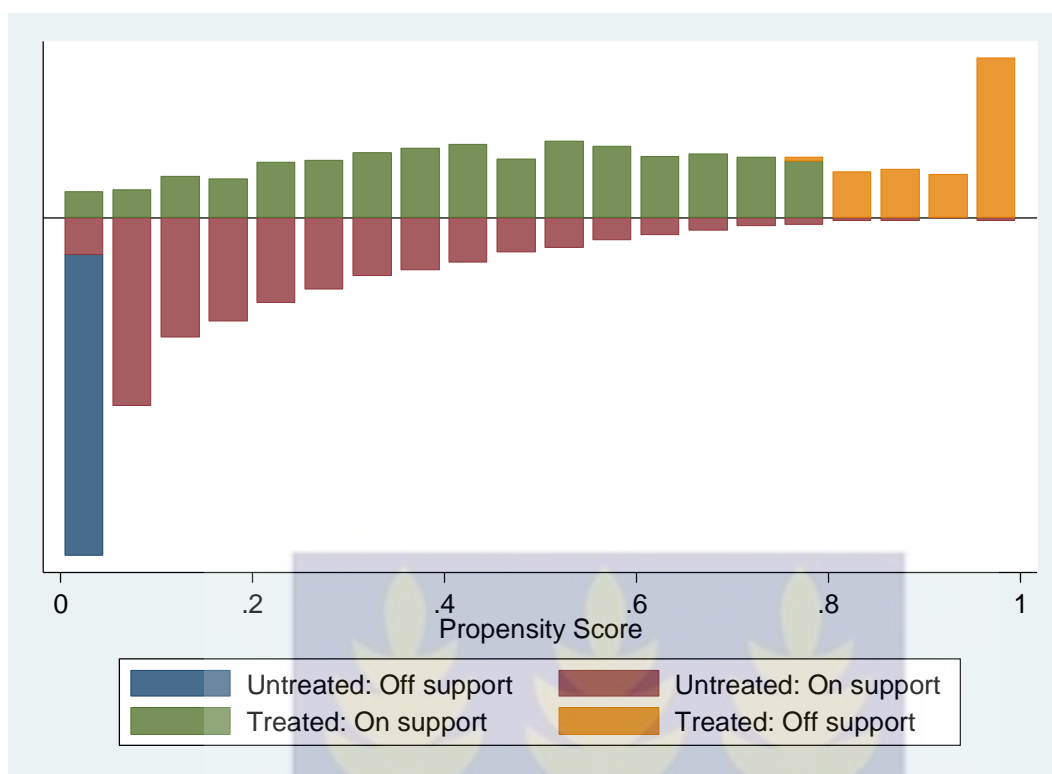


Figure 5.1 Distribution of propensity scores for matched sample

Table 5.3 Indices of the Matching Quality

Outcome Variable	Pseudo R2 (Unmatched)	Pseudo R2 (Matched)	Mean bias (Unmatched)	Mean bias (Matched)	Bias reduced (%)
welfare	0.322 (0.0013)	0.002 (0.9987)	23.8	1.7	50

P-values in parenthesis

Source: Author's estimation

Table 5.3 above presents the indices of the quality of the matching process. The outcome shows a substantial decrease in the absolute bias of the outcome variable, welfare. Here, reduction in the mean absolute standardized bias between matched and unmatched samples is used to ascertain the balancing powers of the estimation. From the table, the mean bias before and after matching is 23.8 and 1.7 respectively, shown in columns four and five. It can be observed that

after matching, the mean bias in the covariates is below 20 percent level of bias reduction as proposed by Rosenbaum and Rubin (1985). Thus, the covariates were significantly balanced by employing the propensity score matching approach.

The pseudo-R² before and after matching is shown in the second and third columns respectively with their p-values in the parenthesis. It can be observed that after matching, the pseudo R² is fairly low and the diagnostic statistics do not significantly differ from zero. The pseudo-R² before and after matching is 0.332 and 0.002 respectively with their p-values in parenthesis. This implies that there exist no significant differences between participants and non-participants after matching. The p-value reduced from a highly significant level of 0.0013 before matching to a highly insignificant level of 0.9987 after matching. Thus, there exist no systematic variance in the distribution of covariates between households involved in urban agriculture and those who are not. This implies that the general outcome from the matching process is adequate in balancing the covariates between urban agriculture participants and non-participants (Sianesi, 2004).

Table 5.4 Treatment Effects from att* Approach

Matching Method	Treated	Control	ATT	Std. Error	t-stats
Nearest Neighbor	2249	1037	135.293	227.83	0.594
Kernel Matching	2249	4904	57.943	-	-

Source: Author's estimation based on 2012/13 GLSS Data

The att* approach employed two different matching algorithms (that is, nearest neighbor and kernel matching algorithms) in the estimation of the treatment effect. Employing the nearest

neighbor matching technique, the ATT is 135.29 Ghana cedis. This implies that participation in urban agricultural activities increases the household's welfare (that is, real household consumption expenditure per adult equivalent) by 135.29 Ghana cedis. Using the kernel matching algorithm, the ATT is 57.94 Ghana cedis. The results from the estimation shown in table 5.4 indicate that urban agriculture has no significant impact on household welfare. Results from the psmatch2 approach (shown in appendix 1) also leads to the same conclusion that participation in urban agriculture has no significant impact on household welfare. This result is consistent with the finding of Maxwell and Armar-Klemesu (2000) who find no significant impact of urban agriculture on household welfare for a sample of households in the Greater Accra region of Ghana. Although not significant, the positive impact should serve to suggest that the usefulness or contribution of urban agriculture to household welfare cannot be entirely ruled out.

5.4 Sensitivity Analysis

The estimation of the treatment effects with matching estimators is premised on the assumption of unconfoundedness or conditional independence (CIA), that is, the selection into treatment is based on observable characteristics. In other words, given the propensity score, the outcome variable (household welfare) for no treatment (non-participants) is independent of the treatment assignment (participation in urban agriculture) under the CIA (Rosenbaum and Rubin, 1983b). However, there may exist some unobservable characteristics or variables which may simultaneously affect assignment into treatment (participation in urban agriculture) and the outcome variable (household welfare) which consequently gives rise to hidden bias. Matching estimators are however not robust in the presence of hidden bias (Rosenbaum, 2002). It is therefore necessary to examine whether and to what extent the average treatment effects are robust to possible deviations from this assumption. In light of this, the simulation-based

sensitivity analysis (sensatt) proposed by Ichino et al. (2007) was employed to verify and address this problem.

This approach simulates a (binary) unobservable variable known as the confounder (U) in the data. This confounder is then used as an additional matching factor in combination with the preferred matching estimator. By comparing the estimates obtained with and without matching on the simulated binary variable, we are able to determine the extent to which the estimator is robust to a specific source of failure of the CIA. According to Ichino et al. (2007), the simulated values of the binary variable can be constructed to capture the different hypotheses on the nature of the potential confounding factors. The central assumptions of this analysis are that the assignment to treatment is not unconfounded given the set of covariates and also, the assumption of conditional independence holds given the observed covariates and an unobserved binary variable (Nannicini, 2007).

With regards to this study, the simulation-based sensitivity analysis begins by assigning a value of U to each subject (household) and the outcome. The confounder simulated in this study is the household's food security index. The confounder U, is then treated as any observed covariate. Particularly, it is included in the set of matching variables used to compute the propensity score and in the estimation of the ATT using the nearest neighbor matching approach. Using a given set of values of the sensitivity parameters, I repeat the matching estimation several times (that is, 100 iterations) to get an estimate of the ATT which is the average of the ATTs over the distribution of the simulated U. Therefore, given any configuration of parameters, we can retrieve a point estimate of the ATT which is robust to the specific failure of the conditional independence assumption implied by that configuration.

The simulation-based sensitivity analysis has several advantages. Firstly, the hypothesized associations of the confounder (U) with the treatment (T) and the outcome (Y) are in terms of proportions. Compared to other sensitivity analysis approaches, this helps to avoid a possibly incorrect parametric specification. Secondly the parameters can be selected in a way such that the distribution of the confounder will be identical to that of the observable binary covariates. Thus, the simulation analysis reveals the extent to which matching estimates are robust to deviations from the conditional independence assumption induced by the impossibility of observing factors similar to the ones used to calibrate the distribution of the confounder. Thirdly, it is possible to look for the existence of a group of parameters such that if U were observed, the estimated ATT would be driven to zero hence, analyzing the plausibility of the configuration of parameters (Ichino et al. 2008). Lastly, the simulation-based sensitivity analysis is capable of evaluating the robustness of matching estimates of the ATT regardless of the type of matching algorithm employed (Ichino et al. 2008).

From the simulation-based sensitivity analysis (shown in appendix 2), the simulated ATT is equal to the baseline ATT. From the estimation, the baseline ATT and the simulated ATT is 135.293 Ghana cedis. This implies that the confounder has no effect on both the outcome variable and selection into the treatment. Thus, this simulation sensitivity analysis supports the robustness of the estimates.

5.5 Summary

This chapter discussed the results obtained from the study. The logistic regression indicates that an urban household's decision to participate in agricultural activities is influenced by factors such as education, age, gender and employment status of the household head. In addition, household characteristics such as household size and access to agricultural land also

determine participation. The PSM analysis reveal no significant impact of urban agriculture on household welfare.



CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter provides a summary of the major results of this study. Based on these key findings, some recommendations are suggested. The last section of this chapter presents the limitations of the study and proposes areas for further research.

6.1 Summary of Major Findings

Basically, this study sought to analyze the determinants of urban households' participation in agriculture in Ghana. The study also assessed the household welfare implications of urban agricultural participation in Ghana. Urban agriculture is increasingly becoming more common in most developing countries and serves a variety of purposes in these countries. Many urban households engage in agriculture as a means of ensuring their food security and also securing a source of revenue.

Estimates from the sixth round of the Ghana Living Standards Survey (GLSS 6) reveal that about 30.9% of urban households participate in agriculture. Further estimates reveal major differences between urban agricultural and non-urban agricultural households in terms of age, gender, educational attainment, marital and employment status of the household head. In addition, there exist differences in the characteristics of these households such as household size, poverty status and ownership of agricultural land.

The logit regression technique was employed in examining the decision of the household to participate in urban agricultural activities. The analysis of the household decision to engage in urban agriculture reveals that the characteristics of the household head as well as some

household characteristics are significant predictors of household decision to participate in the phenomenon. Household head characteristics such as age, gender, educational and employment status influence participation in urban agriculture. The age of the household head raises the likelihood of the household participating in urban agriculture. Households headed by males are more likely to participate in urban agriculture compared to female-headed households. Additionally, the educational attainment of the household head negatively influences the household's participation decision.

Characteristics of the household such as the size and ownership of agricultural land significantly influence the household's decision to participate in urban agricultural activities. From the estimates, there exist a positive relationship between household size and participation in urban agriculture. Thus, a household with more members is more likely to engage in urban agriculture compared to households with few members. Similarly, household's ownership of agricultural land positively affects participation in urban agriculture thus, households with access to agricultural land have a higher probability of engaging in urban agriculture and vice-versa.

The last section of this study examined the impacts of urban agriculture on welfare of the household using the propensity score matching approach. Using the att* approach by Becker and Ichino (2002) and the nearest neighbor matching technique, the impact of agriculture on participating urban households' welfare is 135.3 Ghana cedis. Thus, participation in agriculture increases the urban household's real per capita consumption expenditure per adult equivalent by 135.3 Ghana cedis. However, this impact is not significant. Though not significant, the positive impact should serve to suggest that the contribution of urban agriculture to household welfare cannot be entirely ruled out.

6.2 Policy Recommendations

The major conclusions drawn from this study have a number of significant suggestions for policy. The results presented in this study suggest that urban agriculture has the potential of improving the welfare of urban households. However, to ensure that the full potential of urban agriculture in improving urban livelihoods is realized, the following policy recommendations are worth considering:

Firstly, the integration of urban agriculture into urban development plans may be considered by city officials. This can be done by zoning or re-zoning Ghana's urban centers and incorporating agro-residential planning in urban development plans. This implies that urban agriculture should be established as a legitimate and viable economic activity in Ghana. Thus, there is the need for the development of institutional policies and legislative framework that would promote urban agriculture as a critical component of the development process. This will attract most urban dwellers to engage in agriculture since the activity will be considered legal. In addition, urban planners and developers should also recognize urban agriculture as valuable as the use of land for other purposes such as housing and industry. Furthermore, policies for community gardens or allotment should be developed by local authorities to encourage self-food production.

Secondly, policy interventions that address problems such as credit unavailability, lack of inputs and market should be put in place. There should be measures to ensure that urban farmers have access to credit and the necessary inputs especially land and hygienic water for irrigation. This will enable those involved to produce on large scale and also attract new people to engage in the activity. Also, there is the need for the existence of an efficient market for agricultural

produce and the government and local authorities should support and promote the marketing of these agricultural products.

Thirdly, there is the need to encourage urban agricultural diversification which promotes the production of high-valued foods (e.g. mushrooms) that require little cultivation space but offer good monetary returns. Thus, urban farmers should be supported to produce foods that improve their families' food security.

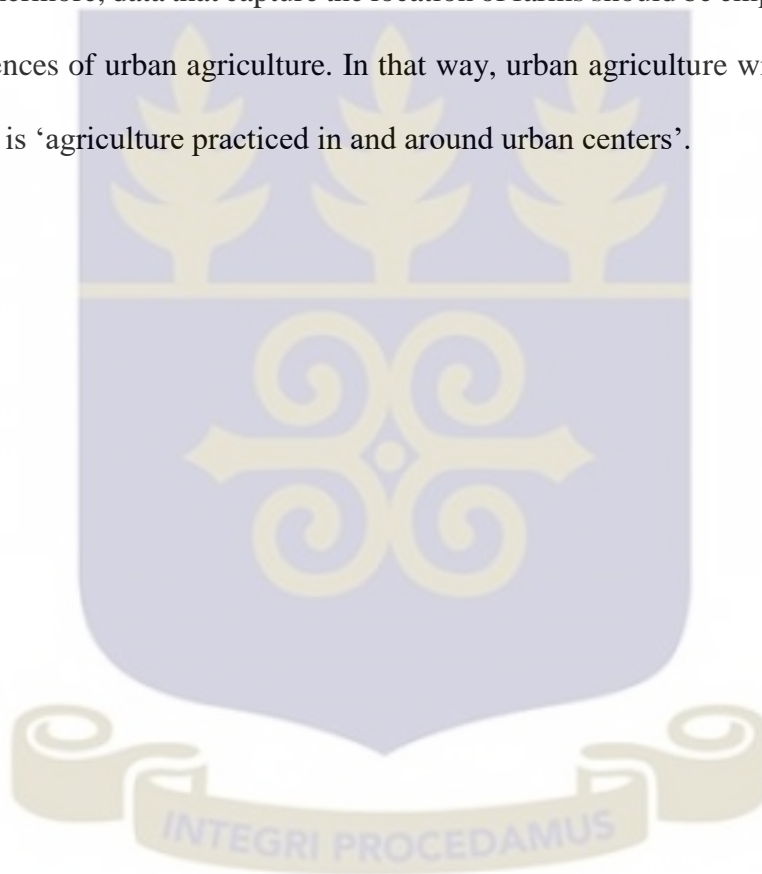
Fourthly, there is the need for education and environmental health awareness. This can be done through the education of urban farmers on good farming practices. This will enable urban farmers to obtain both socio-economic and environmental benefits. In addition, the problem of inadequate extension officers should be resolved. The provision of adequate extension officers will facilitate the dissemination of information and the teaching of good farming practices that will promote the production of food in a healthy way. Lastly, there is the need to build capacity for farmer associations which will provide assistance to farmers.

6.3 Limitations of the Study

The main limitation of this study comes from the data employed in the analysis. Although a significant source of information on household-level economic and demographic characteristics, the GLSS is not designed to capture information on the location of the farm. The dataset captures information on only the location of the household and not necessarily where the farming activity takes place. This absence of information on the location of the farm activity made it impossible to examine strictly urban agriculture but rather agriculture practiced by urban households.

6.4 Suggestion for Further Research

The practice of urban agriculture in Ghana especially has received little attention in economic literature. This study provides some primary information on the economic determinants and welfare consequences of the phenomenon in Ghana. Based on the findings of this study, there exist some prospects for further research work. The existing theoretical explanations for the practice of urban agriculture have been developed within a static framework. There is the need for studies that focus on developing a theoretical framework for participation in urban agriculture. Furthermore, data that capture the location of farms should be employed in carrying out the consequences of urban agriculture. In that way, urban agriculture will strictly refer to its meaning, that is ‘agriculture practiced in and around urban centers’.



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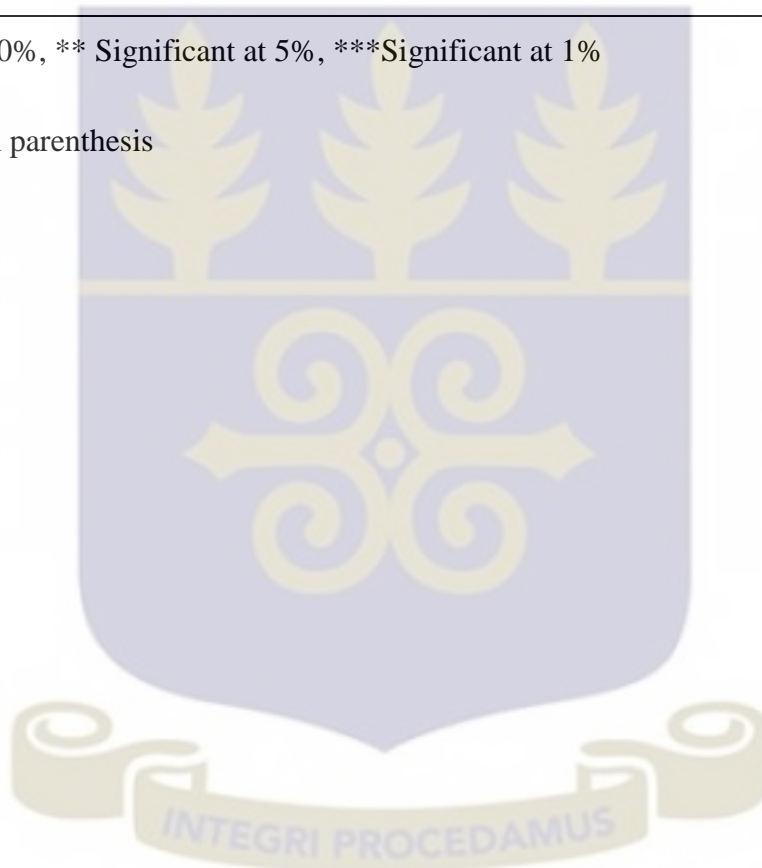
Appendices

Appendix 1: Treatment Effects from psmatch2 Approach

Outcome Variable	PSM			Treated	Control
	ATT	ATU	ATE	(on-support)	(on-support)
welfare	9.971 (0.10)	22.267 (0.15)	18.462 (0.15)	1,687	3,765

*Significant at 10%, ** Significant at 5%, ***Significant at 1%

Note: t-values in parenthesis



Appendix 2. Sensitivity Analysis.

. sensatt welfare agrpart, p(fsecurity) r(100) pscore(mypscore1) comsup logit

*** THIS IS THE BASELINE ATT ESTIMATION (WITH NO SIMULATED CONFOUNDER).

The program is searching the nearest neighbor of each treated unit.

This operation may take a while.

ATT estimation with Nearest Neighbor Matching method

(random draw version)

Analytical standard errors

n. treat.	n. contr.	ATT	Std. Err.	t
2249	1037	135.293	227.830	0.594

Note: the numbers of treated and controls refer to actual nearest neighbor matches

*** THIS IS THE SIMULATED ATT ESTIMATION (WITH THE CONFOUNDER U).

- The probability of having U=1 if T=1 and Y=1 (p11) is equal to: 0.98
- The probability of having U=1 if T=1 and Y=0 (p10) is equal to: 0.69
- The probability of having U=1 if T=0 and Y=1 (p01) is equal to: 0.99
- The probability of having U=1 if T=0 and Y=0 (p00) is equal to: 0.78
- The probability of having U=1 if T=1 (p1.) is equal to: 0.76
- The probability of having U=1 if T=0 (p0.) is equal to: 0.87

The program is iterating the ATT estimation with simulated confounder.

You have chosen to perform 100 iterations. This step may take a while.

ATT estimation with simulated confounder

General multiple-imputation standard errors

```
-----  
ATT      Std. Err.  Out. Eff.  Sel. Eff.  
-----  
135.293  227.830    23.773    0.478  
-----
```

Note: Both the outcome and the selection effect are odds ratios from logit estimations.

. end of do-file

