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RESEARCH REPORT No. 11

The potential of coffee to uplift people out of poverty in Northern Uganda

Swaibu Mbowa, Tonny Odokonyero, and Ezra Munyambonera

May, 2014

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Executive summary

Response to a Problem

Coffee was introduced in Acholi and Lango sub-regions in mid-Northern Uganda, by 1997, at first through pressure from political leaders, as an alternative perennial crop to the traditional cotton crop. This was an effort to fight poverty levels - aggravated by effects of a prolonged civil war in this sub-region. Cotton and other annual traditional food crops had little effect on poverty and introducing coffee, as alternative perennial crop was deemed very important to the region. Systematic coffee planting by the Uganda Coffee Development Authority (UCDA) first as a pilot (around 2001), and subsequently, has had a positive impact in the mid-North sub-region.

To date, 16000 farmers in mid-Northern Uganda have planted 5,441 hectares. The current output in the sub-region is 154 metric tons; with a potential output estimated at 16,323 metric tons at peak and stable production level by 2017. The study identified districts with high potential for coffee production in the sub-region such as; Apac, Lira, Nwoya, and Oyam.

Enablers

UCDA through the elite clonal robusta coffee seedling distribution programme has been the lead agent of change in the transfer of coffee technology in the sub-region. This has been through working partnerships with about 132 *low-cost-low- input* private nursery operators. The nursery operators are key actors in the transfer of proven high performing elite clonal robusta seedlings to farmers in a cost effective way across 14 districts in the sub-region. This programme has had varied success across the sub-region with pronounced responses in only 5 districts (Lira, Nwoya, Oyam, Kole, and Apac) out of the 14 districts in the sub-region.

Coffee Poverty Reduction Evidence

The 2009/10 UNPS data reveal a significant household poverty reduction effect from coffee production; through incremental household consumption expenditure. Results further confirm that coffee producing households are associated with lesser poverty incidence compared to non-coffee producers. The interesting evidence we find from the study suggests that coffee production is a pro-poor intervention due to its strong positive impact on per capita consumption expenditure among the poorest households. Self-reported qualitative assessment reveals that coffee farmers feel that their welfare has improved to satisfactory levels from incomes earned from coffee. A farmer (as an individual) needs 1.4 metric tons of kiboko (unprocessed) coffee in a year to earn 1.2 million shillings-UGX (the threshold annual income) to move out of poverty.

Challenges to Coffee Production in the Sub-region

The UCDA national coffee expansion program anchoring in mid-Northern Uganda is still in its infancy; and faced with the following bottlenecks that need to be addressed to consolidate the proven poverty reduction potential in this sub-region.

1. Limited capacity at the regional Coffee Research Centre (COREC) operated clonal mother garden in Ngetta (Lira district) to produce enough recommended F1 certified clonal coffee seeds for propagation in the sub-region.
2. Contracting private seed producers (farmers) to fill the capacity gap at Ngetta has in itself created a new challenge with seed multiplication where farmers end up producing F3 (instead of the intended second generation F2) clonal Robusta coffee. The F3 is of a lower grade, and with diluted characteristics in terms of (disease resistance, yield, and cup quality).
3. Coffee is still a relatively new crop to farmers in this sub-region. The region requires an efficient extension system to progress the understanding and application of recommended agronomic practices. The situation is being aggravated by the low outreach of coffee specialized extension staff from the local government with limited support; and being lean at the grassroots.
4. Extreme weather conditions (drought) lead to abortion of coffee flowers. This restricts coffee production to one coffee season compared to two seasons in the traditional coffee growing areas (Central, Eastern, and South Western Uganda).
5. Lack of an organized storage, marketing, and processing infrastructure for value addition. Processing increases farmer margins (incomes) by almost threefold - from Ugx 829 to Ugx 2,214 per kilogram. Processing therefore is critically required to add market value, and promote the spirit of collective marketing among the farmers.

Recommendations

- The coffee program needs to be intensified to leverage the poverty reduction effects associated with the crop. Therefore continued support to nursery development at a rate of planting 3 million seedlings annually in the next five years 2014-2018 is necessary. This would require purchasing F1 seeds for propagation by nursery operators. It is envisaged that over the five year period this would increase coffee program by an additional 15 million coffee trees (8,108 hectares) by 2018.
- To achieve meaningful results for poverty, an average farming household of six persons should be encouraged to plant a minimum of 3 acres (i.e. 1350 - 1400 coffee trees) and above.
- Support the development of marketing and processing infrastructure. There is need to strengthen support for the primary marketing and processing infrastructure by both UCDA and private sector.
- Additional support is required to strengthen UCDA's regional coordination extension system, as well as the technical support of the existing local government extension system on coffee management practices. UCDA requires at least additional 3 extension staff to reside in each of the high potential areas of Apac, Oyam and Kole.

To realise the potential economic benefits from coffee planting in mid-Northern Uganda, an estimated total investment of about Ugx 8.1 billion ($ 3.2 million) over the five 5 years (2014-2018), is required. It is envisaged that by 2021, earnings from coffee produced from the mid-

Northern sub-region would amount to $50 million.

The objective of the study was to analyze the potential of expanding coffee production in Uganda, and the resultant poverty reduction effect. Specifically, the study examined the contribution of coffee production towards poverty reduction. We examine the direct welfare gains and/or changes in the lives of coffee farming households in mid-Northern Uganda. The study also identified general challenges faced by the coffee industry in the mid-North. Lastly, the study examines the potential economic implications of coffee expansion in mid-Northern Uganda.

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Acronyms

ATT – Average Treatment effect on the Treated
COREC – Coffee Research Centre
CWD – Coffee Wilt Disease
DFID – Department for International Development
FGD – Focus Group Discussion
FTF – Fair Trade Foundation
ICO – International Coffee Organization
IFPRI – International Food Policy Research Institute
KII – Key Informant Interview
LC – Local Council
MAAIF – Ministry of Agriculture Animal Industry and Fishery
MDG – Millennium Development Goal
MFPED – Ministry of Finance Planning and Economic Development
NAADS – National Agricultural Advisory Services
NaCORI - National Coffee Research Institute
NARO - National Agricultural Research Organization
NCP – National Coffee Policy
NDP – National Development Plan
NR – Natural Resource
PEAP – Poverty Eradication Action Plan
PSM – Propensity Score Matching
SACCO – Savings and Credit Cooperative Organization
SLF – Sustainable Livelihoods Framework
UBOS – Uganda Bureau of Statistics
UCDA – Uganda Coffee Development Authority
UNHS – Uganda National Household Survey
UNPS – Uganda National Panel Survey
USAID – United States Agency for International Development
USDA – United States Department of Agriculture

1. Introduction

Ugandan agricultural development literature points out that agriculture and specifically the type of crop(s)[1] cultivated by households significantly impact on their poverty status. The 2009/2010 national statistics published by the Uganda Bureau of Statistics (UBOS) have portrayed that persons in households that solely depend on income from farming had poverty headcounts halved between 1992/93 and 2005/06, indicating the important role agriculture plays in poverty reduction (UBOS, 2010). It is also argued that increasing the growth rate of the agricultural sector is a critical driver of meaningful and sustainable poverty reduction at household level (MFPED, 2010).

Coffee is one of the perennial cash crops traditionally grown in Central, Western and Eastern regions along the Lake Victoria crescent; and studies by (Appleton, 2001; and Collier, 2001) attributed the relatively low poverty level in these regions of Uganda to coffee growing. Likewise UBOS (2010) found that the a huge portion (46 percent) of households in Northern Uganda were categorized as poor compared to only 11 percent and 23 percent in Central and Western Uganda, respectively. UBOS (2010) strongly attributed the high level of poverty in Northern Uganda to the seasonal type of crop enterprises in which the households are engaged in. This prompted the Uganda Coffee Development Authority (UCDA) to introduce Robusta coffee growing in the mid-Northern region (around 2001) to open up opportunities of earning income by poor farming households in this part of the country.

The medium term objective of UCDA was to provide an alternative source of income to the poor. The long term objective was to sustain Uganda's coffee exports, which was on a downward trend due to the coffee wilt disease (CWD) in the traditional coffee growing regions (Central, Western and Eastern) since 1993. While there was little evidence on the viability of the crop in terms of yield and quality, the results in 2005 demonstrated that the crop could grow favourably in Northern Uganda, and its quality was consistent with other robustas in the traditional areas. From 2005, this motivated UCDA to roll out the programme, supporting more farmers to grow high yield elite (rooted) clonal robusta coffee which is highly resistant to drought and coffee wilt disease. By 2010/11, over 10,000 farmers in the districts of Lira, Kitgum, Gulu and Pader had taken Robusta coffee growing as a commercial enterprise whereby on average about 100 metric tons of coffee was produced from the region (UCDA 2010/11). At household level, UCDA reports that some farmers have planted up to 10 acres and there is potential for several farmers to produce the crop on medium and larger scale farms.

Compared to the traditional Robusta coffee growing areas, the introduction of robusta coffee in Northern Uganda has additional advantages and opportunities for the Ugandan coffee industry in general. These opportunities include; (i) The opportunity for the industry to expand

1 Crop enterprises in Uganda are largely categorized as food and cash crops - which are of high-value, seasonal or perennial in nature

beyond the land constrained traditional coffee growing areas. The mid-Northern sub-region, has abundant fertile and uncultivated land proven to be suitable for coffee production; (ii) The opportunity of growing proven high performing elite (rooted) disease resistant clonal robusta coffee variety by a new generation of coffee farmers; and (iii) The potential to increase (sustain) household incomes from a perennial crop to the resettled families after the civil war, as well as increased export revenue for the country.

This study was motivated by the literature that links varying poverty numbers at household level across the different regions of the country to coffee farming. The literature however lacks strong empirical evidence, and is found wanting both in methodological approach and analytical rigor. This study attempts to address some of the limitations within the available studies linking coffee farming and poverty level in Uganda. The study also provides additional information on welfare and poverty impact of coffee expansion program in the mid-Northern part of Uganda.

The Northern region has got vast land that is undeveloped and can be utilized for expanding coffee production in the country, an opportunity that has been identified by UCDA. Given this vast land, introduction of coffee may help in expanding the level of production in the region, and the country at large. The expansion of coffee growing in Northern Uganda would overcome the problem of declining productivity of aging coffee trees - beleaguered by the coffee wilt disease in the 1990s (IFPRI, 2007).

UCDA has committed resources in promoting coffee production in Northern Uganda, but little is known about how the introduction of elite clonal robusta coffee has been transformative of the livelihoods of coffee farmers, and the other actors along the value chain that is just evolving in this part of the country.

Northern Uganda is the poorest region, compared to other regions in the country (UBOS, 2010), therefore assessing the contribution of the newly introduced perennial crop (coffee) as an enterprise to uplift households in this part of the country out of poverty is important. The study also assembles evidence to inform decision makers about the challenges faced and benefits derived by farmers who are currently engaged in coffee production in Northern Uganda, and thereby highlights areas that need to be addressed for maximum benefit to the coffee industry, and the wider national economy.

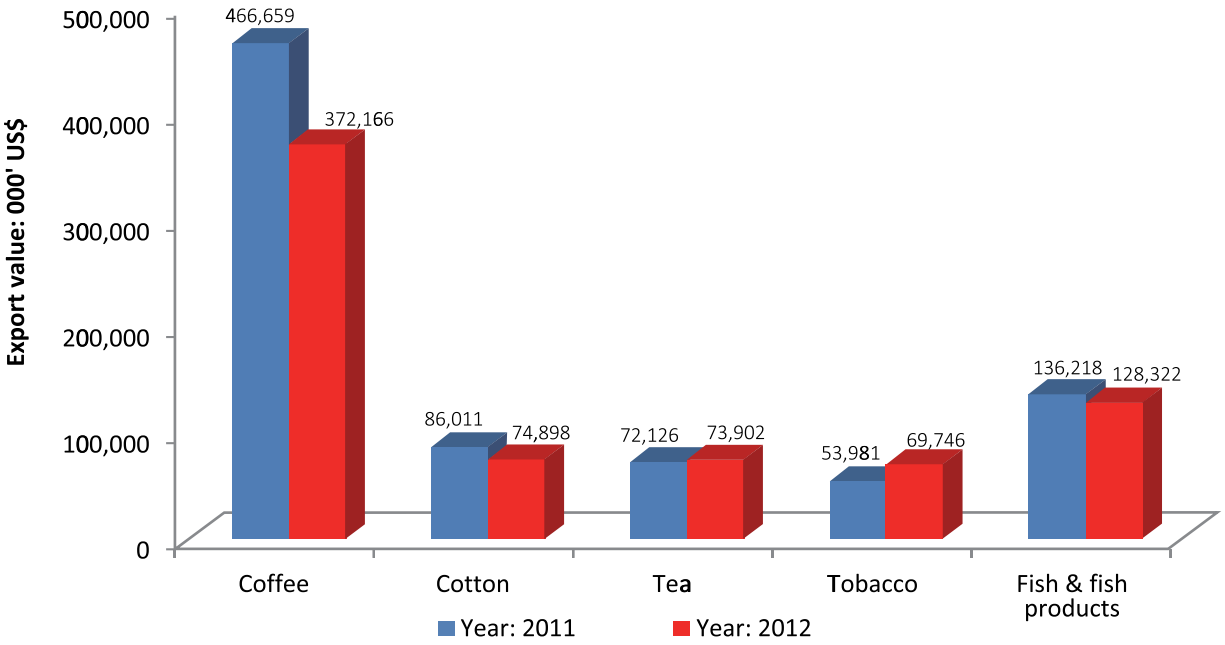
The overall objective of the study was to examine the potential contribution of coffee production towards poverty reduction in Northern Uganda. Specifically, the study examines the direct welfare changes among coffee farming households in mid-Northern Uganda. The study also identifies general challenges faced by the coffee industry in the mid-North. Lastly, the study examines the potential economic implications of coffee expansion in mid-Northern Uganda. The rest of the paper is structured as follow: Chapter 2 is an overview of the coffee sub-sector and poverty in Uganda, chapter three is a review of related literature, chapter

4 contains the methods of analysis, chapter 5 has the findings and discussions, chapter 6 discusses implications of coffee expansion in mid-northern Uganda, and chapter 7 is the conclusion and policy recommendations.

2. An Overview of the Coffee Sub-Sector and Poverty in Uganda

Coffee is Uganda's main foreign exchange earner as shown in Figure 1. Uganda's traditional coffee growing areas are the Central, Western, and Eastern regions (World Bank, 2001; UBOS, 2013); and this provides employment to about one million households (Mbowa et al., 2014). With the introduction of coffee farming in mid-northern Uganda in the recent years (around 2001), coffee is rendered to be of strategic importance to the Ugandan economy as an enterprise that can bring about both macroeconomic stability as the main earner of forex to the country, and inclusive growth.

Figure 1: Export earnings by main export source in 000' US$ (2011 & 2012)



Source: UBOS – statistical abstract (2013)

The coffee sub-sector in Uganda is private sector driven. The private sector players are; farmers' organizations, traders, roasters, and exporters. Coffee is predominantly produced by smallholder farmers and it is one of the crops that the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) has earmarked as a strategic commodity for household income generation and poverty reduction. The liberalization of Uganda's coffee sub-sector in 1991 came in with numerous reforms[2], making coffee related activities to be private sector led ventures.

2 Prior to liberalization, cooperative organizations and the coffee marketing board operated through a system whereby fixed advance payments would be channeled to coffee farmers for production of the crop, with additional payments made via the cooperatives depending on the coffee quality. As a motivation for the farmers to maintain coffee standards before the liberalization, premiums based on coffee quality were paid to the coffee producers in a straight manner.

With the sub-sector liberalized, cooperative organizations and state owned coffee marketing board (CMB) were abolished. Abolition of the cooperatives gave rise to independent and local coffee buyers taking over the role of purchasing coffee. Therefore under a liberalized system the marketing of coffee is undertaken by; farmer groups, aggregators or small scale traders, middlemen, and coffee exporters. Concerning consumption, domestic coffee consumption is an area that needs to be promoted since less than 1 percent of the coffee produced is consumed in the country.

The liberalization of the coffee sector created a gap in the monitoring of the quality of coffee for export. Therefore the Uganda Coffee Development Authority (UCDA) – a statutory body was established in 1991 to play the functions of regulation, coordination, quality assurance, and licensing and export marketing - as well as promoting increased investment in the coffee sub-sector. UCDA was therefore entrusted with the mandate to regulate and develop the sub-sector, under the auspices of MAAIF. Coffee like other crop commodities receives extension advisory services from the National Agricultural Advisory Services (NAADS) and the local government extension services. The Coffee Research Centre (COREC) under the National Research Organization (NARO) is in-charge of coffee research projects.

However, since 1970 – the national coffee production and acreage figures have remained stable at an average of 3 million bags produced and 270 thousand hectares under the plant per year (FAOSTAT, 2013; Mbowa et al, 2013). Pertaining to performance, the coffee sub-sector has over the past decades been performing with minimum progression, and as a result of low performance of the sub-sector, Uganda lost its position as Africa's largest coffee producer (in the 1960s and 1970s), making it now the second after Ethiopia, in terms of exports and production (see Appendix A and B). Currently, Uganda is the world's 10th biggest coffee exporter, and over the last two decades, there has been stagnation in coffee production at about 3 million 60-kilogram bags annually (approximately 180 thousand tones) (FAOSTAT, 2013). According to UCDA's (2013) statistics, average holding is 0.33 ha per household, which is a reflection of production that is dominated by smallholders. In terms of productivity, coffee yields are on average as low as 600 kg/ha (FAOSTAT, 2013), with export earnings of about 400 million US dollars a year.

After operating for decades without a comprehensive coffee policy, Uganda's National Coffee Policy (NCP) was designed and launched in August, 2013 to guide operation of the coffee sub-sector. The recent NCP contains clear-cut interventions that are expected to improve the performance of the sub-sector. The NCP's vision and mission statement is to have *"a competitive, equitable, commercialized and sustainable coffee sub-sector; and increasing coffee production, value addition, and domestic coffee production"*. The set objectives and strategies of the NCP are to be achieved through government interventions in the following areas: mass multiplication and distribution of improved coffee planting materials; reviewing existing coffee laws and enactment of new ones; establishment of a National Coffee Research Institute (NaCORI) within NARO; instituting a coffee research trust fund; improvement of

coffee extension services; and provision of support to or developing coffee farmer groups. The future development of the coffee sub-sector in Uganda would necessitate:–first, expanding coffee growing in nontraditional coffee growing regions of the country with proven potential for coffee production like in the mid-Northern sub-region of Uganda. The second approach would be via increasing production per unit area (intensification). This propelled Vietnam[3] (as a show case) to develop its coffee industry to levels that have surpassed Uganda that used to perform better than Vietnam in the 70's (FAO, 2007; World Bank, 2011).

2.1 Lessons for Uganda from Vietnam's success in Coffee industry Development

In this sub-section, an analogy and comparison of common features between Uganda's and the Vietnam's coffee sub-sector is made. Between the early 1970s and early 1990s, Uganda's acreage under coffee was higher than that of Vietnam (Figure 2), translating to higher coffee production for Uganda. But from the late 1990s, Vietnam's acreage surpassed Uganda's by almost double and this resulted into a steady rise in Vietnam's coffee production, way beyond Uganda's production level by more than sixfold (Figure 3), and Vietnam became the world's second largest coffee producer after Brazil (FAO, 2007; World Bank, 2011). The major success factor in the coffee industry of Vietnam has been through acreage expansion by utilizing land that was undeveloped and later on used for coffee planting in the central highland region of Vietnam (FAO, 2007). Secondly, Vietnam embraced an aggressive coffee intensification drive. Uganda could perform better as Ethiopia (see Appendix A, and B), and also aspire to emulate Vietnam by utilizing the vast undeveloped land in mid-northern Uganda, and also aggressively promote a new generation of coffee farmers growing exclusively the high performing elite clonal coffee in the sub-region. This opportunity in the mid-north has already been identified

3 Amongst other factors that significantly contributed to Vietnam's success in the coffee sub-sector is the institutionalization of relevant government coffee policies (IPSOS, 2013; Lindsey, 2009).

These policies include:

(a) Clear and fertile land incentives. Around the late 1970s, Vietnamese government offered incentives such as clear and fertile land in order to attract the people to migrate and grow coffee in less populated region in the highland. Given Vietnams' large population (about 63.3 million in the 1980s), governments' move of encouraging majority of the people to migrate to the highland region to plant coffee succeeded. Government encouragement also came through dismantling state owned-farms to ownership of small-plot land by small-farmers which culminated into increase in; coffee cultivation area, coffee trees planted, and coffee output in an exponential manner. From this, coffee cultivation drastically increased between the late 1980s and the early 1990s.

(b) Land ownership and usage. Allowing households and small farm owners to have their own coffee plantations, handling land usage rights to farmers, and encouraging forestation. To ease land access, land use rights and ownership was facilitated through the land law reform in 1993 and Land taxes were reduced or eliminated.

(c) Loan policies. Since the late 1970s, another incentive by the government was provision of preferential credit (subsidized) to coffee growers and exporters.

(d) Extension and technology services. Government support to coffee farmers included extension and technology services, channeled through state-run farms. Farmer-to-farmer learning has been encouraged whereby, new coffee producers learn from the old and established ones, and the state-owned coffee enterprises have provided knowledge to both old and new coffee farmers.

(e) Subsidies through Price Stabilization Fund. The Vietnamese government supported the coffee sector when coffee prices have been low through a Coffee Price Stabilization Fund in the 1990s. Coffee exporters contributed to this fund, with a levy on coffee when prices were above US$ 1500 per tonne. The purpose of the fund was to provide a baseline price support to coffee farmers when there is a decline in farmer price below the production cost. Export Support Fund was also established to assist coffee exporters. Support from the fund has been in the form of subsidized credit on extended terms for the contributors.

(f) Import and export policies. Here, the government allows private firms to import fertilizer and there has been removal of quantitative import restrictions and quotas (1999/2001). Import taxes on fertilizers were reduced. On the export side, export taxes/levies were made very modest by the government.

by UCDA but it needs to be aggressively harnessed.

Pertaining to coffee productivity, Uganda performed better than Vietnam in the early 1970s but the trend reversed in the early 80s with Vietnam doing far much better (Figure 4). The factors that were instrumental in Vietnam's coffee intensification program included - adopting high performing robusta coffee varieties; provision of water for irrigation for drier areas, and matching inputs like adequate fertilizers, fungicides and pesticides (World Bank, 2011). Embracing coffee intensification strategies by Vietnam delivered the success desired in the coffee industry. The steady rise in Vietnam's coffee production is associated with steady increase in export earnings (Figure 5)[4].

Figure 2: Acreage

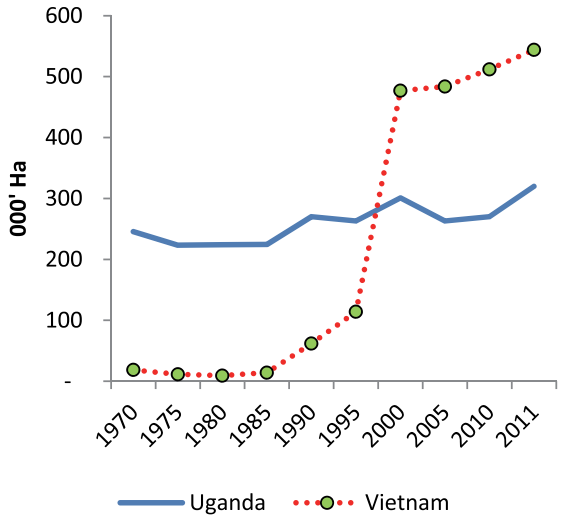


Figure 3:Production

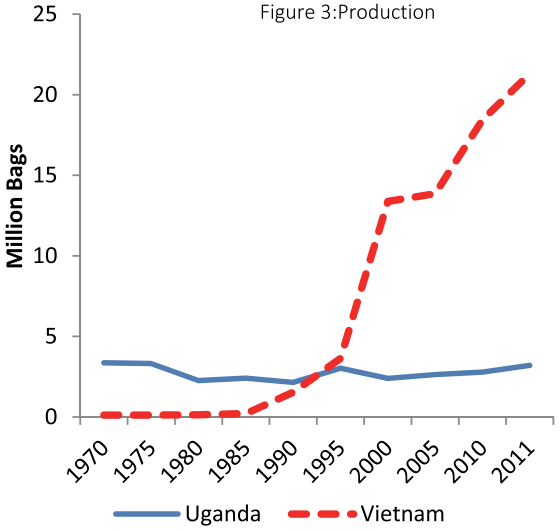


Figure 4: Yield

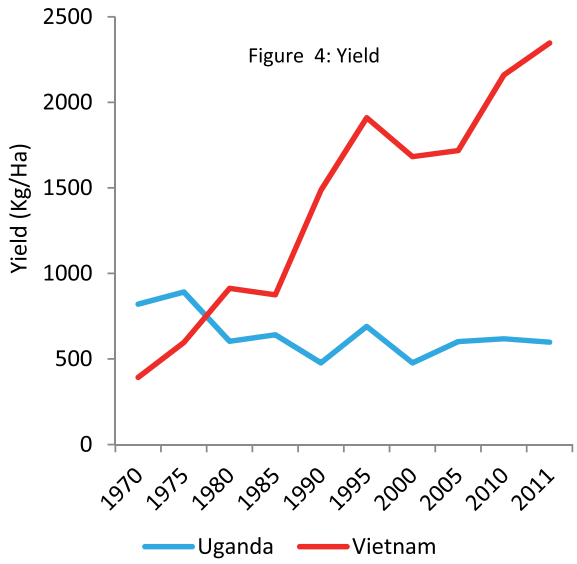
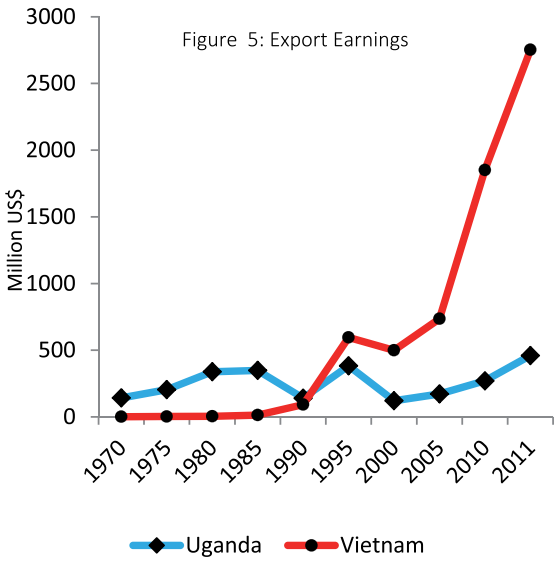


Figure 5: Export Earnings



4 Uganda can have tremendous gains if it increases its coffee productivity at a faster rate and if Uganda's coffee productivity increases by 1%, with the Rest of the World having no productivity gain, it would gain US$1.11 million every year (Liangzhi and Bolwig, 2003)

Figure 6: Regional Poverty Incidence (2005/06-2009/10)

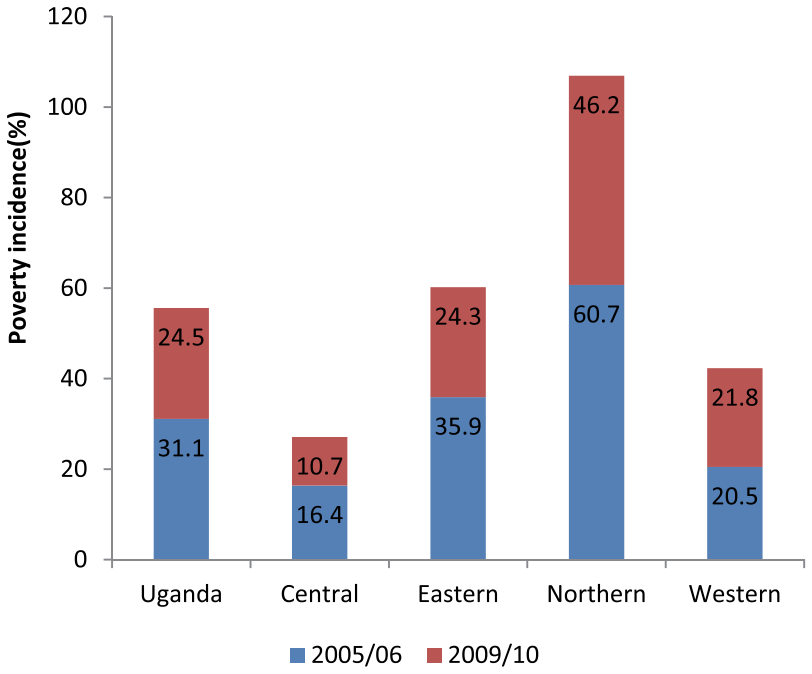
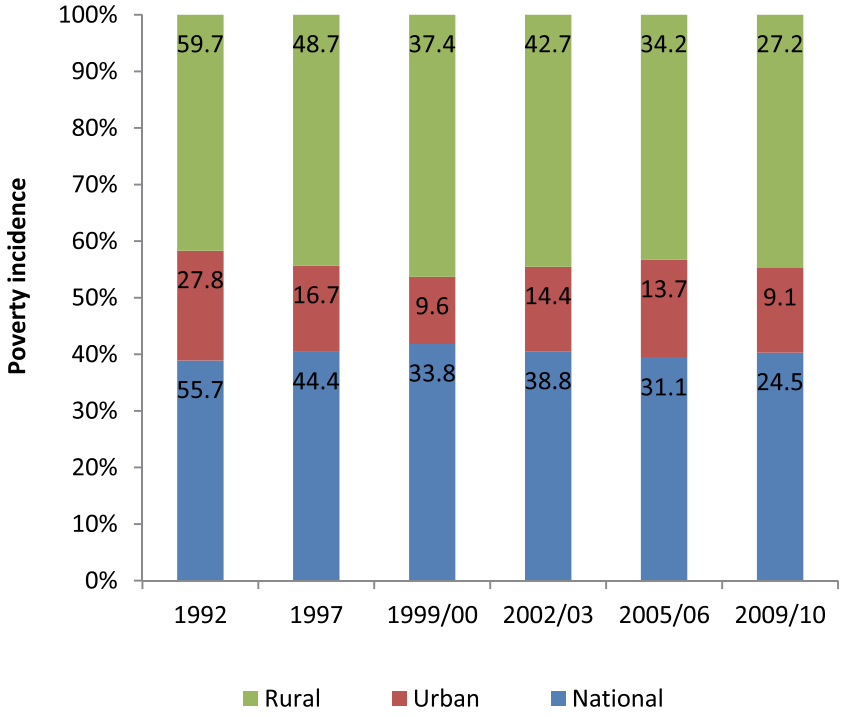


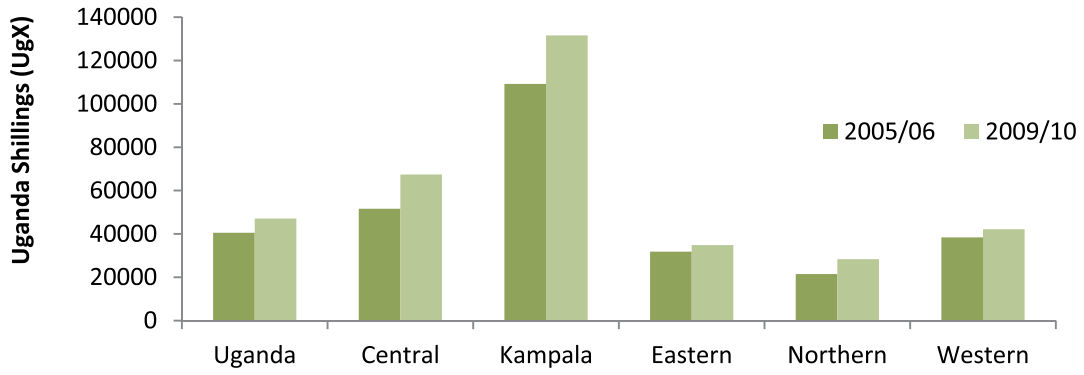
Figure 7: Urban and Rural Poverty Trends (1992-2010)



2.2 Regional Poverty Levels in Uganda

Over the recent past, Uganda has made impressive strides in the fight against poverty, a progress manifested by having achieved the target for the first Millennium Development Goal (MDG) of halving[5] extreme poverty by the year 2015 (MFPED, 2013). This can be attributed to the different government poverty reduction efforts such as the Poverty Eradication Action Plan (PEAP)[6] and lately, the National Development Plan (NDP). What remains as a big challenge however, is the unevenness in poverty levels across the different regions of the country (Figure 6) – with poverty entrenched in rural areas (Figure 7), a situation that calls for more and targeted efforts to fight poverty while taking into account regional dynamics. At regional level, northern Uganda registered the lowest mean per capita consumption expenditure (a measure of poverty) of Ugx 28,400 in 2010 compared to Ugx 47,150 at national level, an indicator that the northern region[7] has the poorest households (Figure 8).

Figure 8: Mean per capita consumption expenditure (2005/2006 prices)



Source: UBOS – UNHS (2009/2010). Central excludes Kampala

5 National poverty figures have reduced from 56% in 1992 to 22% in 2013 (UBOS, 2013)

6 Despite the impressive poverty figures that reveal that majority of Ugandans are not poor with only less than 25 percent of them categorized as poor by official government statistics, there exists a public outcry regarding lack of a decent life or hopeless quality of life of the people especially at grassroots

7 Northern Uganda still has the highest number of poor persons (2.84 million), compared to 2.2, 1.6, and 0.87 million in the eastern, western, and central regions respectively (UBOS, 2010).

3. Reviewed Literature on Relationships between Coffee Production and Livelihoods

Existing literature relates coffee production and changes in international coffee prices to the levels of household poverty in Uganda (Oxfam, 2002; Seaman, 2004; and World Bank, 2011). The World Bank (2011), documents that planting coffee enables households to utilize the proceeds from coffee to meet their basic food requirement and obtain cash income as well. Likewise, Oxfam (2002) maintains that high coffee prices help in poverty reduction in the sense that Ugandan farmers involved in coffee production get in position to purchase assets such as; bicycles, tractors, water pumps, radio, television sets, and motorcycles. On the other hand, when coffee prices decline, a reversed trend can be witnessed in terms of rise in poverty (Seaman, 2004). The World Bank (2011) demonstrates that in circumstances when coffee prices are high, smallholders may not benefit, and most of the gains go to relatively large scale producers or other actors in the coffee value chain. This study investigates the threshold output in coffee production with meaningful impact on poverty levels. This is achieved by imputing gross margins based on the price level at the time of the study (May, 2014) to determine the critical volumes of coffee output a farmer needs to produce in mid-Northern Uganda to move out of poverty. The study also assembles information on effects of primary coffee processing and trading on poverty in the mid-North sub-region.

Appleton (2001) studied poverty trends from 1992 to 2000 in Uganda, and reported that over the period; progress in poverty reduction in the Northern part of the country was modest, compared to other regions. Reduction in poverty was most remarkable in the Central and to a less extent, the Western regions, largely because of difference in coffee growing between regions. However the limitation in Appleton's work of tracking changes in household poverty comes from his direct comparison (using descriptive statistical methods) between coffee and non-coffee growers without an appropriate counterfactual (control) group. In this study, an impact evaluation of coffee growing on poverty is undertaken by use of the propensity score matching (PSM) method where a counterfactual is created and compared to a treatment group. We further estimate the distributional impact of coffee production, an analysis which is lacking in the Ugandan literature.

IFPRI (2007) in a study on economic returns of coffee re-planting program in Uganda revealed that the internal rate of return (IRR) and benefit-cost ratio (BCR) were very high, about 50% and 3.7 respectively. However, the IFPRI study points out that, whereas the coffee re-planting program in Uganda was beneficial in improving the livelihoods of coffee farmers; the largest benefits occurred in the Central region, where the bulk of coffee is grown, followed by the Eastern and Western regions. Meanwhile the largest return to investment occurred in the eastern region, followed by the central and western regions. It was reported that although the results are sensitive to farm production costs and coffee yields, coffee planting or re-planting program still improves welfare and provides a strong case to the government for the need to invest in coffee replanting and/or planting program. The under mentioned IFPRI study renders

the case for re-evaluating the underlying welfare impact of coffee growing - lately introduced in Northern Uganda as a perennial crop, and the likelihood of lifting farming households out of poverty. Collier (2001) points out that, perennial crops in general have been renowned in many African countries as sources of farm income, but only in Uganda has it been such a powerful force for poverty reduction.

Bazaara (2001) studied the impact of agricultural sector liberalization on food security in Uganda, and found that agricultural liberalization increased the fraction of world's coffee price passed to farmers. Liangzhi and Bolwig (2003) contend that coffee can raise farm incomes unless gains at the farm level are siphoned off by domestic traders and exporters through reduced farm gate prices. However, Mbowa et al (2013), show that about 70 percent of the international coffee value margins are retained at farm level. On the other hand, Bazaara (2001) mentions that it is not only prices that are critical for increasing coffee production, but access to adequate land and security of tenure. Under conditions of land tenure impasse, farmers cannot increase acreage, even if they intend to, and they cannot plant trees. This study also explores the extent to which land tenure plays out as a constraint to invest in coffee farming in mid-Northern Uganda.

Liangzhi and Bolwig (2003) measured economic returns for coffee production and illustrated that Uganda suffers negatively if its productivity grows at a slower rate than in the Rest of the World. In the case where Uganda increases its coffee productivity by 1% and the Rest of the World makes no productivity gain, Uganda gains US$1.11 million per year. If Uganda has no productivity increase and the Rest of the World increases productivity by 1%, then the loss for Uganda would be US$ 837,000 in every year. Summarily, this study shows that increasing productivity of coffee in Uganda raises producer income but the costs of increasing productivity should be lower than the derived benefits; and Ugandan coffee producers must continuously increase productivity in order not to suffer a decline in income. When coffee yields are low, the potential of generating income by the households that produce coffee is dwindled (World Bank, 2011).

USAID (2010) reports that coffee plays a great role in terms of revenue generation through exports in Uganda. In relation to supporting livelihood and/or contributing to rural poverty reduction, USAID further elaborates that; farmers sell their coffee as soon as it is harvested in order to spend on necessities such as - Medicare and school fees; and if better processing of coffee is done, Uganda has the potential of doubling its income - for instance when farmers move away from home processed coffee and increase on processing at wet mills, for better and consistent quality. Mbowa et al (2013) demonstrate that, poverty levels can be reduced where an individual person is enabled to produce over 700 kilograms of clean coffee per year. This study provides a detailed investigation on the implications of coffee expansion in mid-Northern Uganda to the national economy in general, and the direct welfare impact on farming households in particular. The study also unveils detailed information on implications of a continued investment in the coffee growing program in mid-North sub-region in terms of

export revenues to Uganda.

Oehmke et al (2011) used the Difference-In-Difference (DID) method to examine changes in income and poverty among smallholder coffee farmers in Rwanda from USAID supported coffee interventions. The study takes farmers linked to coffee washing stations as a 'treatment group', and those not linked as the 'comparison group'. The DID results revealed that the USAID supported coffee interventions increased average smallholder income by US$1,776 between 2000 and 2010. It was also reported that there were statistically significant differences in income growth rates between the treatment and comparison groups over the 2000 – 2010 period. Incomes of the treatment group grew by 27% faster than that of the comparison between 2000 and 2005. While over the extended period 2000 – 2010, the treatment group's incomes grew by 82% faster than the comparison group's incomes.

According to FTF (2012), around 125 million people depend on coffee for their livelihoods worldwide through the generated income, and provision of the much needed rural employment for both men and women in the labour intensive production and harvesting processes. In Ethiopia, nearly a fifth of the population, depend on coffee for their livelihood. In Uganda, about a million smallholder farming households produce coffee, and the coffee sub-sector value chain activities is a source of income for around 2.5 million people or 8 percent of the population. However, FTF warns that the importance of coffee to poverty among households can be reduced in situations of a drastic fall in coffee prices – like the 1999-2004 coffee crisis when the price of Arabica plummet to 45 cents a pound (a 30-year lowest price). This had devastating social, economic, and political consequences for countries throughout Africa, Asia and Latin America. Export earnings fell from around $10bn to $6bn, reducing rural incomes and trapping coffee farmers and their families into poverty (FTF, 2012). Hundreds of thousands of coffee farmers were forced out of business, many abandoning their farms in search for work in cities or migrating to neighboring countries, along with thousands of landless plantation workers. As part of literature, we also make a review of the overtime trends in international coffee prices as a source of risk that might negatively affect the outcomes from concerted efforts to promote coffee growing in mid-Northern Uganda (appendix I).

3.1 Farming (cropping) System Literature

According to (Osiru, 2006), the Kagera basin in Uganda faces increasing threat as a result of population pressure and unsustainable farming practices. The problem of land degradation and declining productivity are created due to unsustainable and inefficient farming system. Areas studied in the districts of Kabale, Ntungamo, Mbarara and Rakai have widespread soil erosion which has caused wide scale forest clearing, poor methods of farming, bush burning and overgrazing. Osiru argues that as a mitigation measure, there is need to strengthen soil conservation and integration of agro-forestry into farming systems. The general observation from this study was that production practices are poor – for example use of cultivators that are unimproved and low yielding on seedbeds that are not adequately prepared. Majority of

framers plant late, use low plant population and irregularly weed crops. Shortage of land makes farmers to use the same land over and over again. A farming practice like shifting cultivation has the capacity of sustaining crop productivity, and minimizing soil erosion to enhance subsequent crop yields. A practice like crop rotation helps in reducing threats of pests and diseases, and it's also useful for alternating crops with high demand for nutrients with those that have low demand. A few farmers use fertilizers, pesticides, and crop residues or animal manure. Farmers often graze fields that are left fallow and subsequently, crops gain from improved fertility. In the Kagera basin, areas with high rainfall are associated with perennial crops (like coffee) production meanwhile low rainfall areas are associated with annual crop production. Peasants mainly grow bananas and coffee, and they often intercrop with annual crops such as beans, maize, coco yams, and sweet potatoes among others. Intercropping is practiced (for instance banana-coffee farming system) and this provides soil cover throughout the year hence a positive effect on soil conservation. Mulching is also important and reduces soil erosion. Major intercrops include for instance; banana/coffee/coco yam, and banana/ Irish potato/pumpkin (in Mbarara); beans/maize/cassava, and millet/maize/beans (in Rakai).

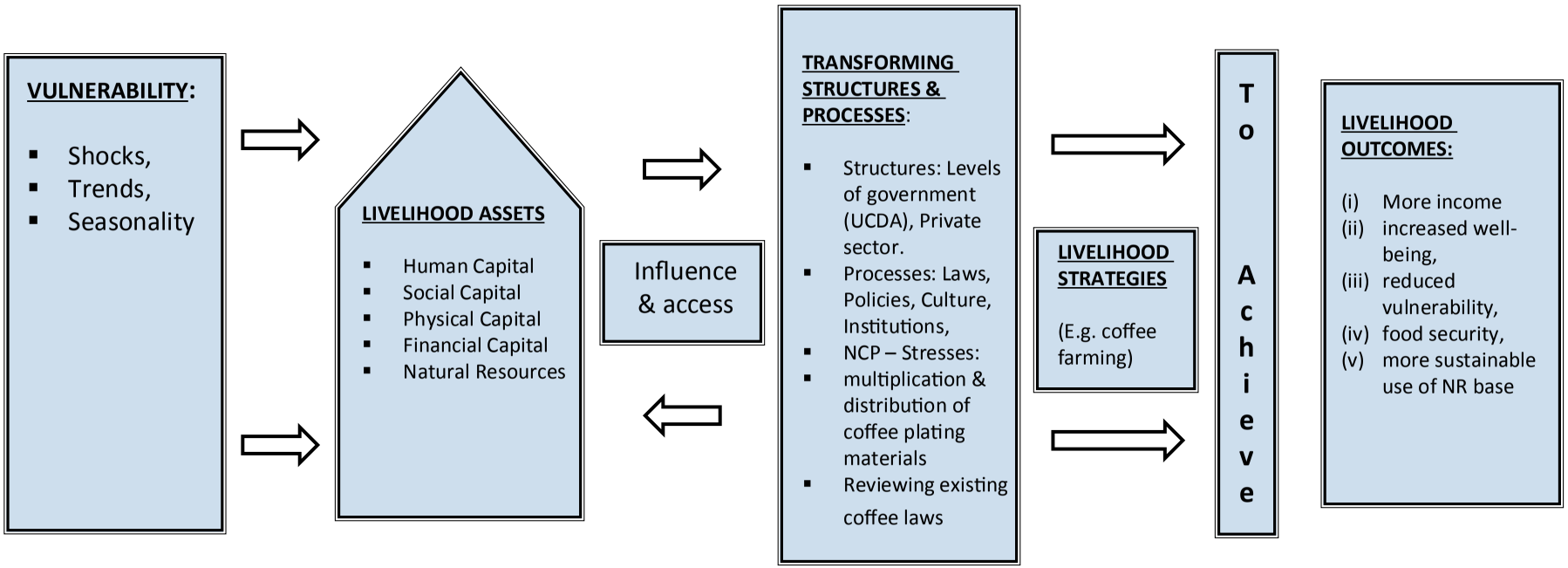
A field trial in Ghana by Opoku-Ameyauh et al (2003) investigated the agronomic performance and economic returns (profitability) of intercropping coffee with other crops (such as jack bean, cowpea, maize, cassava, and plantain). The trial spanned over the period 1996 – 2001. From the study results, intercropping does not significantly affect coffee stem girth. During the first year of the trial, intercropping coffee with cassava significantly increased the coffee plant height. It was also found out that intercropping coffee with cassava reduced coffee yield significantly by about 47%. The reduction in yield when intercropped with plantain was 16% but not significant. Intercropping coffee with jack bean, cowpea, and maize raised coffee yields by 19.1%, 2.0%, and 21.6% respectively. The highest economic return (in terms of discounted net benefit) was observed when coffee is intercropped with cassava however, we find this result contradicting with result mentioned earlier which shows that intercropping with cassava significantly reduces coffee yield. Other than cassava, Opoku-Ameyauh et al observed high economic returns with intercropping in the order – plantain, jack bean, maize, and cowpea. Lowest economic returns were observed in the control groups which comprised sole coffee with chemical weed control and sole coffee with manual weed control. The study recommends the use of cassava and plantain combinations for peasant farmers to realize income and food security, while the maize and jack bean combinations are recommended for commercial farmers with the aim of achieving high production level for coffee export.

3.2 Conceptual framework

The DFID (1999) Sustainable Livelihoods Framework (SLF) is used to conceptualize and analyze the relationship between coffee production and household poverty or livelihood transformation. The SLF framework (Figure 9) is used to illustrate how different poverty reduction interventions impact on people's poverty status (measured by livelihood outcomes). Different studies have used the SLF to assess the impact of programs in diverse settings or fields,

including the impact of various agricultural interventions on livelihoods (Adato and Meinzen, 2002; Hella, 2005). Accordingly, the framework is an effective tool in the conceptualization and understanding of household poverty reduction efforts, and is widely applied in evaluation of household livelihoods. Furthermore, its strength and appropriateness especially for this study is because it allows for various levels of analysis such as individuals or households. As such, our analysis was applied to Uganda's National Household Survey data.

Figure 9: The Sustainable Livelihoods Framework



Source: Adopted from DFID (1999)

The SLF is a theoretical model that is useful in planning for development activities that are new and it is also used in examining the contribution of existing programs or activities to people's livelihood (DFID, 1999).

The framework starts by enlisting **vulnerability factors** that affect the livelihood of people occasioned by: (i) trends in population, resource, technological, governance and national/ international economic trends); (iii) shocks (such as; human health shocks, natural shocks, conflict, economic shocks, and crop/livestock health shocks); and (iii) seasonality (price, production, health and employment). In the context of this study, the source of vulnerability relates to overdependence on seasonal crops which perpetuates high levels of poverty and welfare degradation of farming communities in mid-Northern Uganda.

The framework at the second level, emphasizes access to or ownership of **livelihood assets – (**i.e. human capital; social capital; natural or stock of natural resources; physical capital) that are key in influencing livelihood strategies. In the context of this study, being involved in coffee production as a livelihood strategy can be influenced by livelihood assets (factors) such as: educational level; social networks like group membership; access to water; access to information; land ownership; household assets; and financial resources like credit or savings among others. These factors (variables) were taken into account (and controlled for) in the empirical estimation of the probabilities of being involved in coffee production (the treatment). The framework at the next level enlists the **transforming structures and processes**[8] that also influence livelihood strategy: The SLF categorizes transforming structures as the *"hardware*" (e.g. public or private organizations for instance UCDA); and processes are termed as the *"software"* e.g. policies like the national coffee policy (NCP) meant to streamline the development and expansion of coffee production in nontraditional coffee growing areas. Others include; culture, and power relations – age, gender, caste, and class.

The **livelihood strategies** in the SLF are various activities that can be undertaken by the people to achieve **livelihood outcomes.** In the context of this study, one such strategy is participation in a productive venture such as coffee growing. Within the same perspective of the framework, it is postulated that the choice of livelihoods strategy (or choice of participating in an intervention), for instance coffee farming is influenced by different factors such as ; skills or education (human capital), access to financial resources, physical infrastructure, social capital – like membership in groups, and transforming structures and processes. These factors were controlled for, in the analytical methodology employed in this study to impute the propensity scores (probabilities) of participating in coffee farming.

In the analysis of poverty under the SLF, one way to get uplifted or skip out of poverty is through

8 These comprise of; organizations, institutions, policies, regulations/legislation that affect livelihood. These factors affect livelihood by exerting influence on; access to different capital and livelihood strategies, exchange terms between the different forms of capital, and the gains/returns arising from a given livelihoods strategy.

asset build up (DFID, 1999). Hella (2005) maintains the same idea - acquisition of more assets using income that is derived from coffee shows welfare improvement. Therefore, analyzing asset accumulation can help in gauging to what extent coffee farmers in the mid-North have been uplifted out of poverty. In this conceptual setting therefore, individuals' livelihood or poverty status can be measured using variables such as; asset accumulation (wealth index) or household incomes, which are affected by the livelihood strategy for instance an intervention like coffee production. In this study the authors use household consumption expenditure (which is a proxy for permanent income) as a **livelihood outcome**. We then examined the impact of coffee production on livelihood outcomes and/or poverty status of the people engaged in coffee farming.

4. Methodology

The study employed a quasi-experimental design, where two groups are compared – coffee producers (as the *treatment group)* and non-coffee growing households (*comparison group*). The information on the two groups was excerpted from the agricultural module of the 2009/10 national household survey data collected by the Uganda Bureau of Statistics (UBoS). Field validation was also carried out to obtain qualitative data that were used to corroborate results from the quasi-experimental design.

4.1 Data source

The Uganda National Panel Survey (UNPS) data were used for the analysis of the impact of coffee production on poverty. The UNPS (2009/2010) is nationally representative, and is part of the periodic national household surveys conducted by UBOS. Data are collected following a two-staged stratified sampling approach whereby in the first stage, enumeration areas (districts and rural/urban locations) were drawn using probability proportional to size and in the second stage, systematic sampling was used to draw the final sampling units (households). Details of the survey design can be found in UBOS (2010). Because of inadequate data points on coffee producers in Northern Uganda in the dataset, overall impact estimation was done at national level and this is advantageous because of national representativeness. The two groups that were used to estimate impact (coffee and non-coffee producers) were therefore selected at national level.

To examine the direct welfare gains and changes in the lives of coffee farming households as well as challenges along the coffee value chain in the mid-North, primary data (mainly qualitative) were collected using focus group discussions (FGDs) and key informant interviews (KIIs) from mid-northern Uganda. The FGDs were guided by checklists, which captured coffee farmers' group dynamics and case scenarios, including perceptions of the coffee and non-coffee farmers. The KIIs guided by checklists, were used to capture data pertaining to the views and perceptions of key informants (stakeholders) in the districts covered. In addition, different forms of photographs were taken from the field, ranging from coffee farms and farmers, local technology being used, coffee nurseries, and coffee stores and trading activities.

4.2 Fieldwork

Four districts documented to have had interventions from UCDA in the coffee planting program in the mid-north were purposively selected for fieldwork. Field consultations with the regional UCDA field offices also informed the district selection process through identification of districts which are more active in regard to coffee related activities. Lastly, budgetary consideration also contributed to the influence on the choice of the number of districts covered and with all these factors taken into account, fieldwork for the study therefore covered 4 districts in the mid-north – Apac, Lira, Nwoya, and Gulu, between February and March 2014. The four

districts were selected from a list of 14 districts which was obtained from UCDA. Ranking was done based on coffee tree population in each district and districts were assigned to 3 different categories. Finally, purposive selection of districts followed, from the; upper, middle, and lower level boundaries. See list of districts with number of coffee trees in Table 3.

4.2.1 Selection of coffee farmer groups and key informants

At the time of the study, records showed that there were 55 registered coffee farmer groups at the sub-county level (UCDA, 2010/2011). Only one registered coffee farmer group that had been involved in production for at least 3 years (as per the coffee production cycle) was identified and purposively selected for FGD in each of the four districts. Also, non-coffee farmers were identified from within the same location of the coffee farmers for group interviews. Therefore, from each of the 4 selected districts, two FGDs were conducted at sub-county level, one with the coffee farmers and the other with non-coffee farmers.

The research team conducted twenty Key Informant Interviews in the 4 districts. The stakeholders who were interviewed (key informants) include; district production officers/ coordinators, district agricultural officers, district NAADS coordinators, district secretaries for production, UCDA field based officials, and identified coffee value chain actors (such as; input dealers, nursery operators, and coffee traders). We did not conduct interviews for coffee processors due to their non-existence in the entire mid-north. Also, no specialized coffee transporters were identified hence transporters were not part of key informants.

4.3 Data analysis

4.3.1 The Propensity Score Matching (PSM) method

Propensity Score Matching (PSM) method of impact evaluation was employed to analyze the contribution of coffee production towards poverty reduction. The basis of choice of PSM as an analytical method was: (i) The availability of nationally representative UNPS secondary data used by UBOS to track poverty levels in the country; (ii) The added advantage with the UNPS data is the ability to link (merge) household measures of poverty provided for in the socio-economic module, and the agricultural module of the survey instrument which provides extensive information on household crop enterprises.

The *'gold standard'* method of impact evaluation - Randomized Control Trial (RCT); could not be employed in the circumstance, due to the time element required to set up the experiment of coffee growing which takes about 3 years to mature; so as to collect the required data for performing RCT. The other likewise quasi-experimental method like Difference-in-Difference (DID) lacked a clear baseline given that coffee farming was introduced in the mid-north in 2001. The available UNHS 2005/06 data would not yield an appropriate baseline data.

In the absence of randomization, a quasi-experimental method like PSM has been widely used for impact evaluations based on observational data or cross sectional samples without random placement. We adopted this approach (PSM) for our analysis. The method is increasingly and widely applied for evaluating the impact of economic policy interventions in sectors like health for clinical trials, and agriculture (Becker and Ichino, 2002; Rosenbaum and Rubin, 1983; IFPRI, 2010).

Using the PSM, we compared two groups: households that produce coffee (denoted by $C_i = 1$ for household i) and those that do not produce coffee (denoted by $C_i = 0$). The coffee producing households (treated group) are matched to non-coffee producing households based on the propensity scores.

Firstly in general terms, the average treatment effect on those who are treated (ATT) under the matching method is given by the expression:

$$E[Z_1 - Z_0|X, C = 1] \quad (1)$$

Where $E[Z_1|X, C = 1]$ Outcome for the treated (in terms of consumption expenditure), which is observed directly, and $E[Z_0|X, C = 1]$ is the counterfactual which is not directly observed; and X is a set of observable characteristics.

Since the counterfactual is not directly observable, we follow the PSM procedure such that it is estimated by the outcome of the comparison group - the Right Hand Side term in the expression below:

$$E[Z_0|X, C = 1] = E[Z_0|X, C = 0] \quad (2)$$

Turning to the specific estimation procedures under the PSM, the ATT was estimated following the steps described below. The techniques of estimation are; radius/caliper, nearest neighbor, stratification and kernel matching

Step1: Estimation of propensity scores.

The propensity scores were estimated using a probit, which is a binary discrete choice model. It should be noted that we ran the probit model just to enable us to construct two comparable groups, before arriving at the actual impact estimation. Therefore, our final aim was not arriving at the probit results per se, but to use the probit as one of the PSM steps for statistically constructing a comparison group such that we can match the treated and non-treated groups, in order to allow us move to the next steps and finally estimate impact using the ATT approach. The probit specification is expressed below and it follows the factors

9 Details of PSM estimation procedures can be found in Becker and Ichino, 2002.

that are likely to influence participation in coffee farming as conceptualized based on the Sustainable Livelihoods Framework.

$$Pr(C_i = 1) = \sigma_0 + \sigma_1 Land_i + \sigma_2 Ten_i + \sum_j \sigma_{3j} H_{ji} + \sum_l \sigma_{4l} COMM_{li} + \sum_r \sigma_{5r} FIN_{ri} + \sum_d \sigma_{6d} REGL_{di} + \sigma_7 Z_i + \sum_k \sigma_{8k} Input_{ki} + \varepsilon_i \quad (3)$$

Where C represents program participation (treatment) such that; $C_i = 1$ if the household head is a coffee producer and 0, otherwise.

The regressors are observable characteristics which include: Land ownership and tenure system denoted by Land and Ten respectively. H is a vector of household characteristics which comprise of; age of household head (including age squared), household size, sex of household head, marital status, education, number of rooms occupied by household (as a proxy for household living standard), and ownership of assets (such as; houses, television – TV, radio, bikes, cycle, vehicle, phone, other electronic equipment, and other household assets like lawn mowers.

Table 1: Variable description for the PSM probit

Variable	Type	Definition
Coffee	Binary	1 if household head is a "coffee producer" and 0, otherwise
Land ownership	Binary	1 if household "owns land" and 0, "otherwise"
Land tenure	Categorical	1 if the tenure system of land ownership is "freehold", 2 if "leasehold", 3 if "mailo land", 4 if "customary", and 5 if "other"
Household variables		
Sex	Binary	1 if household head is "male" and 0 if "female"
Age	Continuous	Age of household head in years
Age squared	Continuous	Age^2
Household size	Continuous	No. of people living in a household
Marital status	Categorical	1 if household head is "married monogamously", 2 if "married polygamous", 3 if "divorced/separated", 4 if "widow/ widower", and 5 if "never married"
Education	Categorical	1 if household head "never attended any formal school", 2 if "attended formal school in the past", 3 "if currently attending formal school"
Rooms	Continuous	Number of rooms occupied by household
Ownership of houses	Binary	1 if household "owns house(s)", 0 "otherwise"
Ownership of TV	Binary	1 if household "owns television", 0 "otherwise"
Ownership of radio	Binary	1 if household "owns radio", 0 "otherwise"
Ownership of bikes (bicycle)	Binary	1 if household "owns bike(s)", 0 "otherwise"
Ownership of cycle (motorcycle)	Binary	1 if household "owns motorcycle", 0 "otherwise"
Ownership of vehicle	Binary	1 if household "owns vehicle", 0 "otherwise"
Ownership of phone	Binary	1 if household "owns phone", 0 "otherwise"
Ownership of other electronic equipment	Binary	1 if household "owns other electronic equipment", 0 "otherwise"
Ownership of other household assets	Binary	1 if household "owns other household assets e.g. lawn mowers", 0 "otherwise"
Community variables		

Variable	Type	Definition
Places lived for >=6 months at one time since 05/06	Continuous	Number of places a household head has lived in for at least six months at one time since the year 2005/2006. This variable proxies mobility of the household head, and as a priori expectation, the more mobile a household head is, the lesser the chances of participating in coffee production
Distance of main water source from dwelling	Continuous	How far the main water source is, from dwelling (distance in kilometers)
Amount of money paid for water per month	Continuous	The amount of money paid by household for water per month, on average (cost of water)
Membership in LC committee	Binary	1 if household head is "a committee member of LCI/LCII/LCIII", 2 if "non-member" – a measure of membership in community associations/groups (social capital)
Financial access/services variables		
Membership in SACCOs	Binary	1 if household member has "used a SACCO to save money", 0 "otherwise" – can measure financial and/or social capital
Credit access from a bank	Binary	1 if household member has "borrowed any money or taken out a loan from a bank ", 0 "otherwise" (credit access)
Health insurance for any household member	Binary	1 if household member currently has "health insurance ", 0 "otherwise"
Crop or any other agriculture insurance	Binary	1 if household member currently has "crop or any other agriculture insurance ", 0 "otherwise"
Regional/Location variables		
Region	Categorical	0 if "Kampala", 1 if "Central without Kampala", 2 if "Eastern", 3 if "Northern", and 4 if "Western"[10]
Location	Binary	Location of household head - 1 if "urban", 0 "otherwise"
Consumption expenditure	Continuous	Total household consumption expenditure
Fertilizer	Binary	1 if "any organic fertilizer has been used on parcel[11]", and 0 "otherwise" – indicator of household's experience on input use (fertilizer)
Pesticide/herbicide	Binary	1 if "any pesticides/herbicides have been used on plot/parcel", and 0 "otherwise"

Source: UNPS – household and agriculture questionnaires (2009/2010)

10 NOTE: Variables such as tenure and region among others take certain values for the different categories but all values have no weight attached to them. In the regression model, they were treated as categorical variables (not continuous), by using the prefix, i, in stata. The values should not therefore be confused with measurement styles like the Likert Scale measurement.

11 The parcels considered are those within the Enumeration Areas (EA)

COMM is a vector of community level variables or characteristics comprising of; number of places lived in for at least 6 months since 2005/06 (as a proxy for household head mobility) and is expected to negatively influence the probability of participating in coffee production (a priori), distance of main water source from dwelling (in Kilometers) that constitute access to social service (water), amount of money paid for water per month which represents the cost of water, and membership in Local Council (LCI, II and III) committee.

FIN is a vector of financial access/services variables which capture; membership in SACCOs (which can also proxy social capital - always enhanced by membership in community associations), credit access from the bank, health insurance for any household member, and crop or any other agriculture insurance. REGL represents a set of geographical locations of households including urban-rural locale. Z is total household consumption expenditure that captures household welfare. Input is a vector of household's capabilities in the use of agricultural inputs such as fertilizer and herbicide / pesticide, and E is the error term. Details of the variable descriptions are provided in Table 1.

We included total consumption expenditure as a regressor in the probit model rather than the per adult equivalent consumption expenditure because the balancing property requirement under the PSM methodology was satisfied by inclusion of total expenditure as a variable compared to - per adult equivalent; or consumption expenditure quintiles.

Step2: The actual matching

Households were matched on the basis of their first stage estimated propensity scores (probabilities of participation in coffee production). The propensity scores are denoted by *Pr* (*X*) where *X* comprise of the observable characteristics.

Step3: Impact estimation

Estimation of the impact of coffee production on consumption expenditure (ATT) was done using the procedures of Becker and Ichino (2002) for ATT calculation, based on the technique of radius matching estimator (*attr*). The results of alternative techniques - kernel matching estimator (*attk*), nearest neighbor matching estimator (*attnd*), and stratification matching estimator (*atts*) are reported in Appendix F.
ATT is therefore given as;

$$ATT = \frac{1}{n_1}\sum_{i\in I_1\cap S_p}(Z_{1i} - E[Z_{0i}|C=1,Pr]) \quad (4)$$

Where $E[Z_{0i}|C=1,Pr]$ =$\sum_{j\in I_0} W_{ij}Z_{0j}$; which estimates the counterfactual. I_1 is a set of program participants (coffee producing households); I_0 is a set of non-participants (non-coffee producing households); S_p represents the region of common support (i.e. where good matches are found); n_1 is the number of households in the set $I_1 \cap S_p$; and W_{ij} represents weights

for every observation (household head) in the comparison group (non-coffee producers) according to the distance between these observation's propensity scores and the propensity scores of their matches in the treatment group (coffee producers).

Since the nearest-neighbor technique does not impose any restrictions on the distance between propensity scores, bad matches may be compared. Due to this drawback, we have not relied on this technique much as it also generated a positive impact of coffee production on consumption expenditure. The radius/caliper technique yielded the most statistically significant ATT results and the strength it has is that it minimizes or avoids bad matches as it imposes a limit on the maximum distance allowed between the propensity scores.

On estimating the treatment effect of coffee production on poverty, minimal estimation bias was ensured by considering that exposure to treatment (coffee production in this case), was random[12] amongst households with the same propensity scores. Treatment effect was therefore computed after satisfaction of the balancing property test in the model that we used (appendix D – no difference between the two groups). The wide range or rich sets of observable characteristics from within the UNPS dataset used in estimating propensity scores appreciably reduces estimation bias. However, caution was taken not to rule out unobservable confounding characteristics of households that might exist hence not wholly claiming elimination of bias.

4.3.2 Distributional Impact Analysis

Additional analysis was undertaken to allow for deeper understanding of the effects of coffee production at different levels of income (consumption expenditure) using distributional impact analysis approach. Here, estimation of the poverty reduction effect of coffee production was done at different levels in the distribution of consumption expenditure (i.e. impacts on households in the high, middle, low, and lowest classes). We do this for two reasons – firstly, by only analyzing the average impact using PSM, changes in the distribution of consumption expenditure is not revealed but through this analysis we capture heterogeneity in the effect of coffee production (varying effects along the distribution or on different income groups). Secondly, we expect that this type of analysis complements the increasing interest that policy makers have concerning distributional effects of interventions (Frolich and Melly, 2010). In this regard, analysis of the impact of coffee production along the distribution of per capita consumption expenditure was undertaken using the Quantile Treatment Effect (QTE) evaluation method. Particularly, we used the Unconditional Quantile Treatment Effect (UQTE) as opposed to the Conditional Quantile Treatment Effect (CQTE) since UQTE has an advantage over the CQTE in that it is not a function of the covariates, although the covariates are used as controls for the purpose of efficiency in first step regression (Frolich and Melly, 2010).

12 Randomness is also guaranteed during the process of sample selection in the National Household Survey.

Following the estimation framework by Frolich and Melly (2010), if an individual (household head for the case of this study) receives treatment, Z_i^1 would be the outcome realized and Z_i^0 would be realized without treatment. The observed outcome is therefore given by;

$$Z_i \equiv Z_i^1 C_i + Z_i^0 (1 - C_i)$$

Where; Outcome variable is per capita consumption expenditure in this case, and the Binary treatment variable is coffee farming

The outcome based on quantile regression model is as below:

$$Z_i^c = \theta^\tau X_i + \beta^\tau c + v_i \; ; \; Q_{vi}^\tau = 0$$

$i = 1,2, \ldots . , n.$ $c \in \{0,1\}.$ $Q_{vi}^\tau = \tau^{th}$ quantile of the unobserved random variable v_i and X comprises covariates which are the same observables that we used for computing propensity scores under the PSM procedures (with exception of consumption expenditure).
θ^τ and β^τ are model parameters, with β^τ representing the CQTE at quantile τ.

The UQTE for quantile τ is expressed as; $\Delta^\tau = Q_{Z^1}^\tau - Q_{Z^0}^\tau$

Where; Δ^τ = the impact of / on the τ^{th} part of the distribution of *Z* and Q_Z^τ = the τ^{th} quantile of *Z*.

The two assumptions below jointly identify the UQTE;

$(Z^0, Z^1) \coprod C|X$ - the assumption of selection on observables; and $0 < \Pr(C = 1|X) < 1$

We follow weighting estimation for Δ^τ (i.e. the inverse probability weighting approach) – for mathematical derivations and other details of the estimation framework, refer to (Frolich and Melly, 2010). Other details for estimation of QTE are also found in Firpo (2007).
In summary, through the UQTE procedure, we estimate the impact of coffee production on the different parts of the distribution of per capita consumption expenditure such as the 1st, 2nd, until the last decile.

4.3.3 Qualitative Data Analysis

Qualitative data analysis was by and large used in the triangulation of the outcomes from the quantitative analysis of the impact of coffee production on household poverty levels as confirmatory process. The areas analyzed were; self-reported welfare gains from coffee production by households; evaluation of perceptive capabilities for coffee production potential in mid - northern Uganda including availability and access to land, the changing farming system and the environment, coffee output thresholds for poverty reduction, coffee value chain dynamics including general challenges in the coffee industry, and implications of coffee

expansion in the mid - north. This involved the use of detailed notes taken during focus group discussions, and key informant interviews and observations by the EPRC research team during field work. The synthesized field data or responses are reported as summaries, including information boxes. Efforts were therefore made to transcribe information from FGD and key informant interviews by putting together the thoughts or responses of participants. However, the limitation that should be noted with qualitative studies is that FGD approach represents small samples that may not be representative of the population, and there is much less consensus on how qualitative data are analyzed.

4.4 Measuring poverty

The authors of this study used household consumption - a money metric measure of poverty widely used in economics; and in studies of (Ssewanyana and Okidi, 2007; Ssewanyana and Kasirye, 2012) it is pointed out that increase in consumption expenditure[13] makes households move out of poverty; and per adult equivalent consumption expenditure is assumed to be a proxy for permanent income.

The overall or total household consumption expenditure at household level was obtained by using the consumption expenditure per item under the different sub-components and aggregating the different expenditures. Using the adult equivalent, consumption expenditure was converted to per adult equivalent consumption expenditure. To obtain poverty status, the per adult equivalent consumption expenditure was compared to the absolute poverty line. For details regarding the computation of consumption expenditure and poverty status, see Ssewanyana and Kasirye (2012), and Ssewanyana and Okidi (2007)

13 UBOS collected the data for consumption expenditures under different household items and expenditure sub-components. The sub-components considered include household consumption on; food/beverages/tobacco, non-durable goods and frequently purchased services, semi-durable and durable goods and services – details are found in the Uganda National Household Survey report by UBOS (2010).

5. Results and Discussion

5.1 Socio-demographic characteristics of coffee producing households

Results in Table 2 reveal that the majority (84%) of coffee farmers in northern Uganda and at national level (92%) are rural dwellers, which indicate that expansion of coffee production has potential for inclusive growth, as well as rural poverty alleviation. The average size of coffee producing households is seven people, which offers added advantage for availability of family labour to work in coffee farms. This stability in family labour is strengthened by having the majority (78%) being married. On average, the farmers are aged 51 and 49 years in the north and at national level respectively, which is indicative that the predominantly unemployed youth in the country could potentially be excluded from initiatives targeting the production level of the coffee value chain. This may call for creation of programmes that can attract the youth to engage in coffee growing. Likewise, female headed households are less likely to benefit from coffee production development initiatives given that majority (80%) of coffee farmers in Northern Uganda, and country wide (76%) were male, respectively.

Table 2 further shows that the majority (75%) of coffee producers have attended formal schooling implying that uptake of extension information and skills by coffee farmers is likely to be high, if well designed and tailored specifically for coffee farmers. All the coffee producers in Northern Uganda own land which is entirely under customary tenure system. The research team during field work established that the predominately communal customary land tenure system in Northern Uganda was not a limiting factor to coffee growing (see Figure 18 in section 5.4.2). The fact that all coffee producers own land is confirmed by the qualitative result of this study where it was found through fieldwork that lack of land access was never stated as a challenge in coffee production. Similarly, farmers in FGDs contend that ownership of land under customary land tenure system is not in any way a barrier to coffee farming.

Table2: Socio-demographic characteristics of coffee producers

Variable	Coffee producers Northern Uganda			Coffee producers Uganda		
	Obs.	Mean	S.D	Obs.	Mean	S.D
Age	26807	51.0	1.727	852285	49.00	0.934
Sex – male (%)	26807	80.0	-	852285	76.00	-
Marital status (%):	26807					
▪ Married monogamously		78.0			56.96	
▪ Married polygamous		16.5			18.52	
▪ Divorced/separated		3.7			6.65	
▪ Widow/widower		1.8			16.11	
▪ Never married					1.75	
▪ Total					100.0	
Region (%):				852285		
▪ Kampala					0.60	
▪ Central (without Kampala)					40.70	
▪ Eastern					22.55	
▪ Northern					3.15	
▪ Western					33.00	
▪ Total					100.00	
Location – Urban (%)	26807	16		852285	8.00	-
Fertilizer use on parcel (%)	25813	0		781750	16.00	-
Use of pesticides/herbicides on parcel/plot	25813	0		777648	5.00	-
Household size	26807	7	0.6234	852285	7.00	0.301
Education: Never attended formal school (%) Attended/attending formal school (%)	23307	25 75		827452	16.00 84.00	- -
Land ownership (%)	26571	100		852049	89.00	-
Land tenure (%)	25187			816537		
Freehold		0			59.49	-
Leasehold		0			0.68	-
Mailo		0			9.32	-
Customary		100			30.16	-
Other		0			0.36	-

Source: UNPS - 2009/10. Note: Numbers of observations are weighted samples based on the UNPS survey/panel weights.

None of the coffee producers in the north reported use of either fertilizer or herbicides/ pesticides on their parcels. The study results (Table 2), are reflective of tendencies of selective adoption of only the high performing elite robusta coffee germplasm. At the national level, 16% and 5% of the coffee producers reported use of fertilizer and herbicides on their parcels respectively.

5.2 Coffee Production Potential in mid-Northern Uganda

The 2013 regional UCDA statistics in Table 3 reveal that ten districts in the mid-Northern sub-region have a proven potential in Robusta coffee production. There are over 15,000 coffee farming households registered by UCDA, with a total of over 10,000 hectares of land under elite high yielding clonal coffee; producing 150 metric tons of kiboko (dry coffee cherry) in the entire mid-Northern sub-region.

Table 3: Coffee Production, Acreage, and Farming Households, by District (2013)

DISTRICT	Number of Trees	Hectares	Farming Households	Metric Tons
Lira	1,677,624	1,511	2,512	29
Apac	1,864,028	1,679	2,253	33
Oyam	1,356,310	1,222	1,989	21
Kole	1,131,505	1,019	1,398	9
Dokolo	851,289	767	1,116	4
Aleptong	543,278	489	727	3
Amolatar	325,000	293	566	3
Otuke	259,600	234	236	-
Kaberamaido	8,800	7	44	-
Gulu	533,812	739	1,334	13
Nwoya	963,202	1,333	2,408	25
Amuru	438,165	606	1,095	11
Pader	76,635	106	191	4
Lamwo	38,285	38	18	-
Total	**10,067,533**	**10,045**	**15,887**	**154**

Source: UCDA (2013) regional Office Data Base

The relatively high potential coffee producing districts in the mid-North are Apac; Lira; Nwoya and Oyam in terms of the number of households producing sizeable amounts of coffee; acreage under coffee and output in metric tons (Figure 10). The research team encountered (during field observation trips) some good coffee fields in Apac district (Pic 5.1) in March 2014 at the peak of the dry season. Nonetheless, the high output within the earmarked high potential districts highly collates with acreage under coffee (Figure10). It is therefore evident that an extensive coffee growing program in the mid-Northern sub-region (where land is available) could deliver the long-term government goal of increasing coffee production and exports.

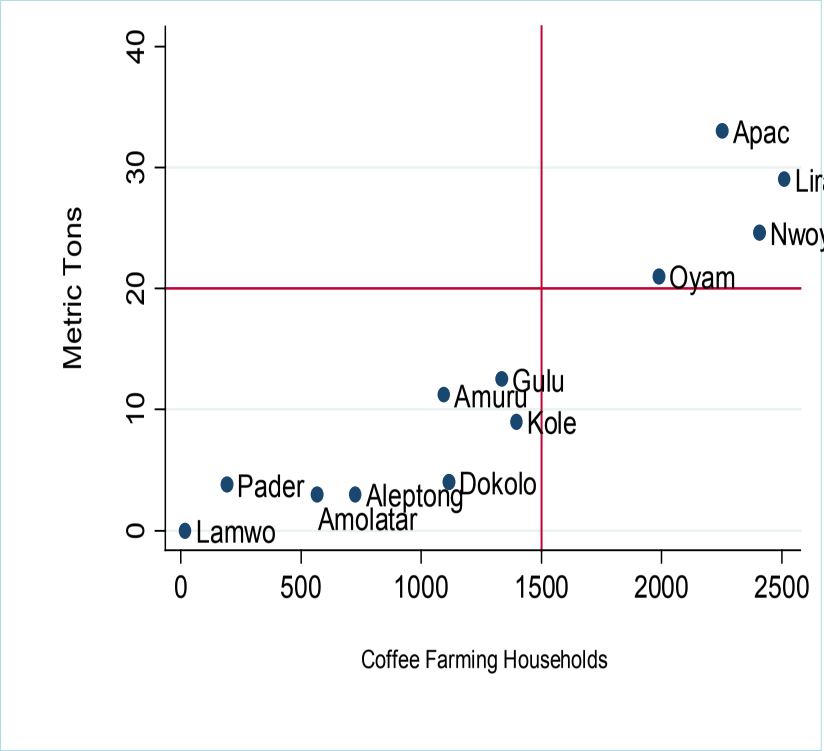
Self-reported revelations in information Box 1, captured from farmers interviewed in FGDs allude to the key motivating factors for farmers to grow coffee, and these included: coffee being a convenient long-term investment; sensitization about coffee and its importance; drive to stabilize farm incomes; and support to farmers provided by UCDA. These are key pointers and pathways that need to be leveraged by UCDA to foster success in the coffee expansion program in mid-Northern Uganda. Nonetheless the coffee growing program needs to be intensified to leverage the poverty reduction effects associated with the crop. Apparently what emerged from FGD is that coffee is still ranked low by farmers (i.e. *fifth,* sixth, and *seventh) as a* cash crop within the mid-Northern sub-region of Uganda (Table 4).

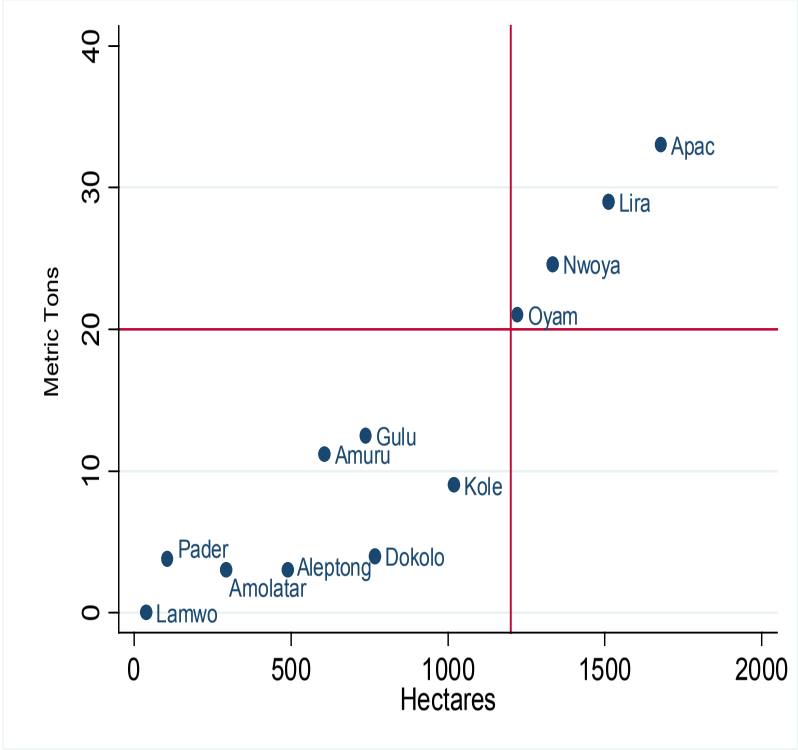
Table 4: Ranking of Crop Commodities as Cash Crops across Districts

Main Cash Crops	FGDs within the Respective Districts			
	GULU (Unyona Kal)	NWOYA (Gen Anyim)	LIRA (Agali)	APAC (Apac Coffee Growers)
Beans	*2*	*5*	-	-
Ground nuts	*1*	*2*	*2*	-
Coffee	*6*	*7*	*6*	*5*
Maize	*4*	*4*	*4*	*1*
Bananas	*5*	*3*	-	-
Simsim	*3*	*1*	*1*	*3*
Cotton	-	*6*	-	-
Rice	-	-	*3*	-
Sorghum	-	-	*5*	-
Sunflower	-	-	-	*2*
Cassava	-	-	-	*4*

Source: EPRC Field Work, March 2014

Figure10: Distribution of coffee farmers in the mid-northern sub-region by district





Source: UCDA (2013) regional Office Data Base

Pic 5.1: A good Coffee Field in Apac district (Evidence of high prospects for coffee production in mid-Northern Uganda)

Box 1: Narrative of farmers' self-reported motivators to start coffee growing:

The following factors were identified as motivators for starting to grow coffee:

- ***Coffee is a Convenient and long term investment:*** The farmers perceive coffee as a crop that does not bother them with land clearing on a yearly basis, unlike seasonal crops (those who grow coffee just open land once). Infact the elderly note that coffee best suits their age since one opens land just once, hence less labour requirement. In addition, coffee growing is seen as an investment that does not only benefit those who planted the crop, but can also go a long way in providing livelihood support for the future generation and in reiteration, farmers said that "coffee is long lasting and if you die, your people can depend on it in future"

- ***Sensitization about coffee farming and its importance:*** Increased sensitization by UCDA opened the opportunity for farmers to break the traditional believe that - coffee cannot grow well in mid-northern Uganda. There was a prolonged perception that coffee as a crop could do well only in the known traditional coffee growing (Eastern, and central) regions of the country. Some farmers picked interest in coffee growing after learning from and observing coffee farmers, that living standard improves through coffee production. Radio sensitization program has also played a positive role in making farmers to pick interest in coffee growing. Farmers reported that through radio programmes, they were informed that coffee fetches better or more stable prices, and that the land/soil in the mid-north is good for or can allow coffee farming.
  One farmer interviewed from one of the famer groups - *Gen Anyim coffee farmer group in Nwoya district, Koch Goma sub-county* narrated that:

  > *"I was displaced during the Lord Resistance Army (LRA) war, and went to Mukono district where I saw the benefits of coffee growing. When I came back to Nwoya after the war in the year 2008, it was the time when coffee farming was being introduced in our area by UCDA, and because of what I saw in Mukono, I immediately picked interest and decided to start growing coffee"*

- ***Income Stability and less riskiness:*** Experience in crop farming has proved that seasonal price variability is lower for coffee, compared to other crop commodities (i.e. maize, beans, simsim; sunflower etc.). Additional advantages with coffee are: the market is readily available; at the moment coffee is less susceptible to diseases; and is hardly eaten or destroyed by other animals while in the garden, and coffee cannot easily be stolen by thieves from the garden compared to crops like maize.

- ***Support to farmers:*** The concerted support by UCDA to farmers to access seedlings at no cost, inspired most farmers to start coffee growing. Apart from UCDA, it was reported by farmers that other Non-Governmental Organizations like; NUCAFE; World Vision; ACORD; have also provided farm implements to farmers for instance; seeds, seedlings, oxen, ox-ploughs, and hand hoes.

5.2.1 Access to Land offers better prospects for Coffee farming.

The potential for coffee production in the mid-north is indeed auspicious; and access to the available, vast and unutilized land is one of the core resources that render prospects for coffee production bright in the immediate future for Uganda. The land tenure system was reported

by farmers; technocrats; and political leaders as less of a hindrance to coffee farming. Land in Northern Uganda is communally owned (Table 2), but individuals who are part of respective clans or communities are allowed to go ahead and grow crops including coffee. Most of these individuals are reported to have land ownership rights in their respective clans. Also, land boundaries are clearly known especially by the elders who are in most cases used in the identification of land demarcations to address any land dispute that may arise.

This response from the FGDs and KIIs is in line with one of the results obtained from UNPS data which reveals farm families that own land on a customary basis are more likely to engage in coffee farming than freeholders (Table 7, Section 5.3.3). More farmers are willing to participate in coffee production, as reported by the UCDA's regional office staff. However, the limiting factor remains low purchasing ability among farmers for coffee seedlings; which necessitates continuation of the subsidized UCDA seedling distribution program.

5.3 Effect of Coffee Production on Household Poverty

This section contains results on the impact of coffee production on poverty from the national and regional (northern), perspectives. The results are presented on both the quantitative and qualitative assessment of welfare indicators. The qualitative assessments are based on the field work, which corroborated quantitative results.

5.3.1 Changes in Welfare Indicators among Coffee Farmers

Information on some of the welfare indicators among coffee farmers are presented in Table 5. UBOS uses similar indicators in national household surveys to track changes in the welfare status of households. There was an increase in the average household consumption expenditure of coffee producers by 46% and 24% in the Northern region; and national level respectively. This is a pointer of general improvement in the living standards of coffee producers over the reviewed period.

Furthermore, Table 5 shows that 84% of coffee producing households reported that every member owned at least two sets of clothes and this had not changed between 2005/06 and 2009/10. At national level, this had declined by three percent. Likewise the proportion of households with persons (aged below 18 years) in possession of a blanket rose to 32%, from 25.6%, and at the national level, there was an improvement from 40.6% to 42%.

In terms of feeding practice – measured by the average number of meals taken by household members in a day, results (Table 5) show that the proportion of coffee producing households in northern Uganda that took one meal a day dropped from eleven percent to zero, and those who took the recommended three meals a day substantially rose to 89% (from 20% in 2005/06). At national level, the improvement was marginal, with a slight drop of 0.4% in the proportion of those who took one meal per day, and a rise from 36% to 54.85% for those who

took three meals a day. This set of results (from the national survey data) reflect an improved living standard of coffee producing households in terms of increased access to food to meet daily energy needs. When triangulated with the qualitative results from fieldwork, we observe consistent findings where improvements in feeding regimes as a result of improved income from coffee were reported by farmers during the FGDs (refer to Box 2, section 5.3.6).

Table 5: Coffee & non Coffee producer's welfare indicator trend – descriptive statistics

Indicator	Distribution of coffee producing households				Distribution of non-coffee producing households			
	Northern Uganda		Uganda		Northern Uganda		Uganda	
	2005/06	2009/10	2005/06	2009/10	2005/06	2009/10	2005/06	2009/10
Mean consumption expenditure: UGX US$	139,652 76.74	204,012 102.56	269,454 148.07	332,991 167.41	122,116 67.12	183,291 92.15	218,042 119.82	296,995 149.31
Possession of at least 2 sets of clothes by every household member (%)	84	84	91.44	88	72	72	89	85
Possession of blanket for HH members aged<18 years (%)	25.64	32	40.64	42	20	18	39	32
Meals per day (%)								
• One meal	11	0	5	4.56	23	10	9.5	7
• Two meals	63	11	56	38.27	52	49	54	40
• Three meals	20	89	36	54.85	25	39	35	50
• Four meals	5	-	2	2.02	-	2	1	3
Ownership of selected HH assets (%)								
• House	12.5	100	89.6	96.2	29	74	60	70
• Bicycle	43	53	46	47	45	47	32	36
• Motorcycle	5.22	4	3	9	1	3	2	6
• Mobile phone	0	46	15.8	53	10	38	26	54

Source: Calculations from UNHS (2005/06) and UNPS (2009/10) weighted data

Lastly, a general increase in ownership of key household assets is reported among coffee farmers. For all the selected household assets, ownership improved amongst coffee producers over the reviewed period. The improvement was more pronounced in the capacity to own a house in northern Uganda, where all coffee producing households reported that they own house(s), up from merely 12.5% in 2005/06. Such a result is confirmed by the qualitative findings during FGDs in which coffee farmers reported that the income they earn from coffee has enabled them to construct permanent houses within short time periods. An improvement in the ownership of other household assets like bicycles and mobile phones by coffee farmers is observed both in the Northern region, and at national level. When coffee producers are compared to non-coffee producers (Table 5), results show that coffee producers are relatively better off in terms of welfare, as at 2009/10. The relatively higher welfare level of coffee producers is observed both at the regional (northern) and national levels, in regard to; consumption expenditure (both in UGX and US$), possession of at least 2 sets of clothes by every household member, possession of blanket for household members aged below 18 years, average number of meals in a day, and ownership of household assets.

5.3.2 Results from Propensity Score Matching (PSM) method

In the PSM analysis before matching the treated and comparison observations, the total number of households (represented by household heads) was 2988, of which 513 were coffee producers and 2475 were non-coffee producers, at national level (Table 6). Due to missing information on some variables, some households were dropped under the probit model and we ended up with 1718. After applying matching using the probit model analysis (equation 3) to generate the propensity scores, 71 households were lost because they did not have sufficient or good match. The total number of households left after matching was therefore 1647, who lie in the common support region (with 443 coffee producers and 1204 non-coffee producers). However when the caliper/radius technique was applied, the number of households with proper matches within radius reduced to 1634 (of which 439 and 1195 were households in the treated and comparison groups respectively). In the computation of the treatment effect (ATT), the households used (1634) are all within the common support region (i.e. where comparable households or good matches only, were found).

Table 6: Household Matching Outcome from the PSM Analysis

Results	Coffee producing Households	Non-Coffee producing Households	Total
Before PSM	513	2,475	2,988
After PSM	443	1,204	1,647
Caliper Radius	439	1,195	1,634

Source: Calculations from UNPS 2009/10 weighted data – numbers of observations are at national level.

The results from the probit model used for estimating the propensity scores are presented first in table 7, and then results of the impact of coffee production (treatment effect – ATT) are presented in Table 8a.

5.3.3 Factors affecting participation in coffee production

As mentioned earlier in the preceding chapter, the results of the probit model presented here form part of the PSM steps that we used to construct two comparable groups to enable the matching of treated and non-treated. Whereas we used the probit to discuss how different factors influence participation in coffee farming, these probit results are not our final goal. In other words, the probit was used to enable matching of treated and non-treated groups, such that we could arrive at the final aim of estimating impact using ATT.

Table 7 shows results of the probit analysis. The binary response variable used here is coffee farming, which takes the value of 1 if the household produces coffee and 0, otherwise. The explanatory variables comprise of: land ownership and tenure system; household, community, financial access/services, regional, and location characteristics; including household consumption expenditure and agricultural input use, as expressed in the estimated empirical probit model under equation 3, section 4.3.1.

Results (Table7) reveal that land ownership by households significantly and positively influences participation in coffee production. Farmers who own land on customary basis have a higher likelihood of being engaged in coffee production than the freeholders. This stems from the fact that majority of coffee farms (especially in the north) are located on customary land. The older the household head, the greater the likelihood to participate in coffee production, but the result is statistically insignificant.

Homesteads with houses containing more rooms (symbolic of social status) are more likely to participate in the production of coffee. Households that own radio have a higher likelihood of participating in coffee production, and this is perhaps contributed to by the fact that some coffee production campaigns are performed or promoted through radio programmes for awareness creation by Uganda Coffee Development Authority (UCDA) however, the result was not statistically significant. Membership in community associations such as SACCOs, which is a financial access variable that can at the same time act as an indicator of social capital (proxied by being a saver in SACCOs) makes it more probable for participation in coffee production.

The household heads who are divorced/separated or widows/widowers are less likely to carry out coffee production as compared to those who are married monogamously. Stable families are an enhancement to coffee farming through access to family labour and decision making. Owning TV makes it less likely for households to engage in coffee production, a phenomenon that can arise due to the fact that majority of those who own TV in Uganda are people who live in urban areas who may be employing other means of earning a living (livelihood strategies) such as being; in formal employment or engaged in non-agricultural enterprises. Further on household assets, ownership of other electronic equipment (apart from TV, radio, phone) is positively associated with the probability of engaging in coffee production.

Table 7: Results from survey probit regression – factors influencing participation in coffee farming

Covariate	Coefficient	SE (linearized)	t-statistic
Land ownership	0.4268783**	0.1738594	2.46
Land tenure (base category = freehold)			
Lease hold	-0.5031533	0.4297247	-1.17
Mailo	0.105743	0.2340998	0.45
Customary	0.5918579***	0.1583803	3.74
Other	0.8300834	0.5303604	1.57
Household variables			
Sex – male	-0.0957316	0.1292813	-0.74
Age	0.0061273	0.0180917	0.34
Age squared	0.0000419	0.0001696	0.25
Household size	-0.0065798	0.0155365	-0.42
Marital status: Married polygamous	-0.0482462	0.1260645	-0.38
Divorced/Separated	-0.4875772**	0.1910828	-2.55
Widow/Widower	-0.4691565***	0.1583075	-2.96
Never married	0.0238276	0.4306072	0.06
Education: Attended school in the past	0.0660028	0.1241837	0.53
Currently attending school	0.3524869	0.6460432	0.55
Rooms occupied by household	0.1291032***	0.0370195	3.49
Ownership of houses	0.2824148	0.2598419	1.09
Ownership of TV	-0.6575402***	0.1939106	-3.39
Ownership of radio	0.0072639	0.1285565	0.06
Ownership of bikes	-0.1283041	0.1066654	-1.20
Ownership of cycle	0.2335063	0.1785491	1.31
Ownership of vehicle	-0.4574177	0.3448102	-1.33
Ownership of phone	0.0452873	0.0988528	0.46
Ownership of other electronic equipment	1.008068**	0.4299125	2.34
Ownership of other household assets e.g. lawn mowers	0.0155973	0.110669	0.14
Community variables			
No. places lived for >=6 months at one time since 05/06	0.0240918	0.1002568	0.24
Distance of main water source from dwelling (Kilometers)	-0.0831029	0.0540777	-1.54
Amount of money paid for water per month	-0.0000166	0.0000101	-1.65
Membership in LC committee (base category = member)	-0.2052177	0.1274616	-1.61
Financial services variables			
Membership in SACCOs	0.2836469*	0.162986	1.74
Credit access from a bank	0.1105133	0.1938829	0.57
Health insurance for any household member	-0.6872135	0.4474157	-1.54
Crop or any other agriculture insurance	1.999854	1.334333	1.50
Regional variables including urban-rural location			
Region: Central without Kampala	0.428156	0.4083901	1.05
Eastern	-0.9035559*	0.4843695	-1.87
Northern	-2.032725***	0.4999537	-4.07
Western	-0.4330727	0.4329556	-1.00
Location: Urban	-0.2286832	0.1780169	-1.28
Consumption expenditure	-3.21e-07	2.15e-07	-1.50
Experience in input use			
Use of fertilizer (organic) on parcel	0.4184305**	0.171472	2.44
Use of pesticide/herbicide on plot	-.077889	.1806767	-0.43
Constant	-1.202784	0.7299171	-1.65

Source: Computed from UNPS (2009/10) data

No. strata = 5, No. PSUs = 115; Observations = 1716; Population size (weighted) = 2687924; F (41, 70) = 6.33; Pr>F =0.000; *, **, and *** represent significance at the 10%, 5%, and 1% levels of confidence respectively

Two of the community variables that proxy accessibility of social service have negative relationships with the probability of engaging in coffee production, but not significantly i.e. the longer the distance (in Kilometers) to the main water source, the less likely a household engages in coffee production; and higher costs of water (measured by amount of money paid for water per month) reduces the probability of being involved in coffee production. In terms of regional and urban-rural characteristics which represent zonal geographical categorization of household locations, the households in the central region (without Kampala) have a higher probability of being involved in coffee production compared to their Kampala counterparts meanwhile for the case of Northern and Eastern regions where the associations were actually statistically significant, households have a lesser probability of engaging in coffee production as compared to the central category. The findings from the regional characteristics are not surprising and they point to the fact that coffee production in Uganda is still dominant in the traditional coffee growing areas (i.e. Central and Western regions). Lastly, household heads that have experience in the use of fertilizer in their parcels are more likely to engage in coffee production than those who do not use fertilizer.

5.3.4 Average Impact on Household Consumption Expenditure

The results in Table 8a are estimations of the treatment effect of coffee production on consumption expenditure. The impact estimation technique used here follows the PSM algorithm (equation 3) that computes ATT after matching using the generated probabilities in equation 4[14]. The caliper/radius technique, yielded good matches for 1634 households (439 coffee producers and 1195 non-coffee producers) within the radius (0.01). The radius of 0.01 was chosen rather than the default radius of 0.1 to obtain more robust results. Computation of ATT was restricted to the region of common support and by doing so, only comparable treated and control households were considered.

Summary results in Table 8a show that when households get engaged in coffee production, total consumption expenditure and per adult equivalent consumption expenditure on average can potentially increase by about 16% and 13% respectively. Both results are statistically significant at the 1 percent level of confidence. The positive effect of coffee production on total consumption expenditure and per adult equivalent consumption expenditure indicates that coffee growing and/or production is a livelihood strategy that is capable of uplifting households out of poverty, given the fact that household's movement out of poverty comes along with a rise in consumption expenditure. Given that household consumption expenditure is used for measuring poverty status, it follows that for a household to move out of poverty, consumption expenditure has to rise (Ssewanyana and Kasirye, 2012). When we corroborate the PSM result (ATT) by those from FGDs, we find consistency in the findings. The corroborating evidence is that coffee farmers who said they felt the impact of being engaged in coffee production reported satisfactory improvement in welfare or movement

14 The analysis of the impact of coffee on poverty follows seminal work of Rosenbaum and Rubin (1983), and Becker and Ichino (2002).

away from poverty due to increase in and stability of their income. Other aspects signaling the positive contribution of coffee to poverty reduction which were reported during FGDs include empowerment of farmers to - construct houses, accumulate more assets, and afford better clothing and feeding among others.

We also estimated ATT using the; nearest neighbor, stratification, and kernel matching techniques. For each of the techniques, similar results that reflect evidence of a positive impact (ATT) of coffee production on both total household consumption expenditure and per adult equivalent consumption expenditure were found (see Appendix F), hence the consistency and robustness of the findings.

Table 8a: Treatment effect using Average Treatment on the treated (ATT)[15]

Impact on Total Consumption Expenditure				
Treated group. (Coffee producers)	Control Group (Non-coffee producers)	Impact of coffee production (ATT)	SE	t-statistics
439	1195	0.158***	0.046	3.451
Impact on Per Adult Equivalent Consumption Expenditure				
439	1195	0.128***	0.039	3.246

Source: Author's computation of ATT from UNPS (2009/2010) data. ***, **, * statistical significance at the 1, 5, and 10 percent levels respectively

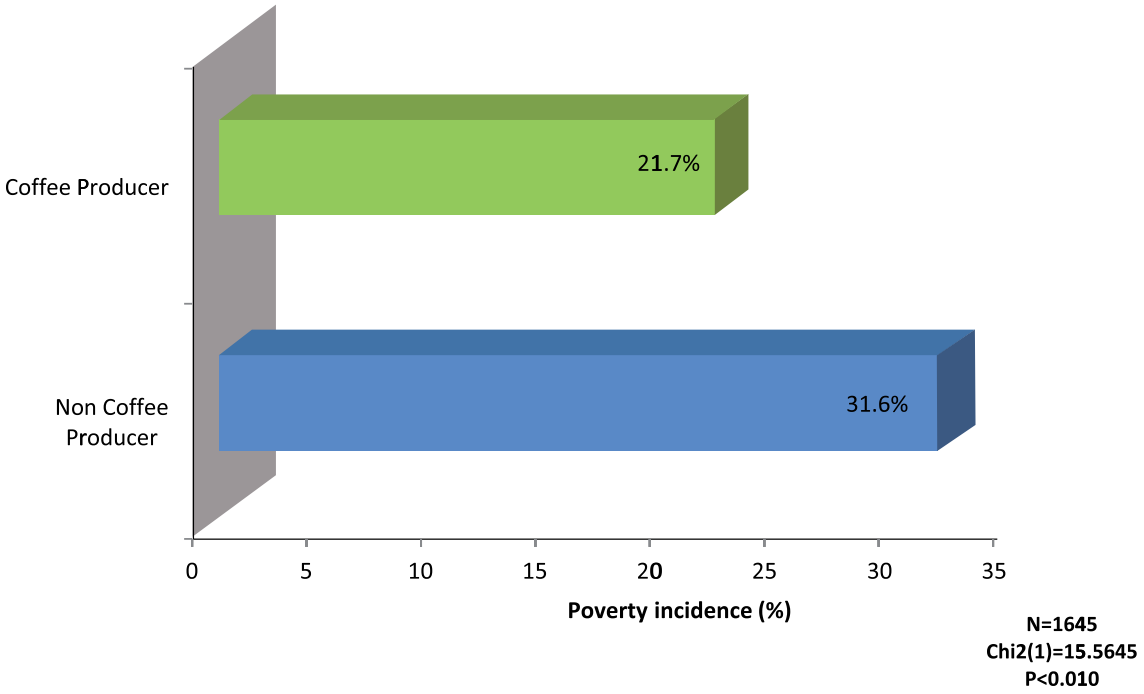
5.3.5 Poverty incidence among Coffee and Non-Coffee Farmers

We also analyzed poverty status in each of the groups (treatment and control) within the common support region and the results (Figure 11) revealed that coffee producing households are associated with lesser poverty incidence (21.7%), as opposed to the non-coffee producing households with higher poverty incidence (31.6%). This finding is consistent with the earlier results on the effect of coffee production on household consumption expenditure and per adult equivalent consumption expenditure. Evidence from these data therefore indicates that coffee production has a strong poverty[16] reduction effect at household level. The study findings tend to be consistent with the works of Appleton (2001) and Oehmke (2011). Such a result is reinforced by the self-reported direct welfare effects mentioned by farmers during FGDs (Figure 12, section 5.3.6) - coffee growing increased the welfare status of coffee farming households.

15 **NOTE:** Numbers of treated and controls are actual matches within radius, based on the caliper/radius matching method of estimation under PSM

16 Poverty incidence here is defined as the proportion of individuals (household heads) who are below the poverty line. A poor individual is one whose per adult equivalent consumption expenditure is below the poverty line otherwise, the individual is non-poor (details for categorizing individuals/households in the poor and non-poor brackets are contained in Ssewanyana and Kasirye, 2012).

Figure 11: Poverty status among the treated and control groups within the common support region



Source: Author's computation from UNPS 2009/2010 data

5.3.6 Coffee Production is Pro-Poor: Results from Distributional Impact Analysis

Table 8b shows results from the analysis of Unconditional Quantile Treatment Effect (UQTE). The findings reflect larger benefits in the lower quantiles as compared to the middle and upper quantiles along the distribution of consumption expenditure. Specifically, we find two key and interesting sets of results. On the one hand, there is evidence of a positive and statistically significant effect of coffee production on per capita consumption expenditure for instance in the 5th, 10th, and 11th percentiles (which form the region of lowest quantiles or tail in the distribution, where relatively poorer households are found). Secondly, no significant effect of coffee production was observed amongst those who are relatively richer – for instance from the median until the upper percentiles (such as – the 50th, 75th, and onwards). These findings are similar and consistent to those from the Conditional Quantile Treatment Effects (CQTE) analysis (see appendix J for CQTE). This implies that coffee production has greater positive impact on poorer households in terms of more rapid welfare improvement or poverty reduction among the poorest households, and thus it appears to be a pro-poor intervention. Therefore, further promotion of coffee growing in a poverty stricken region like northern Uganda can significantly contribute to movement of people in the region out of poverty, and the realization of growth that is pro-poor in nature.

Table 8b: Distributional impact – Unconditional Quantile Treatment Effect

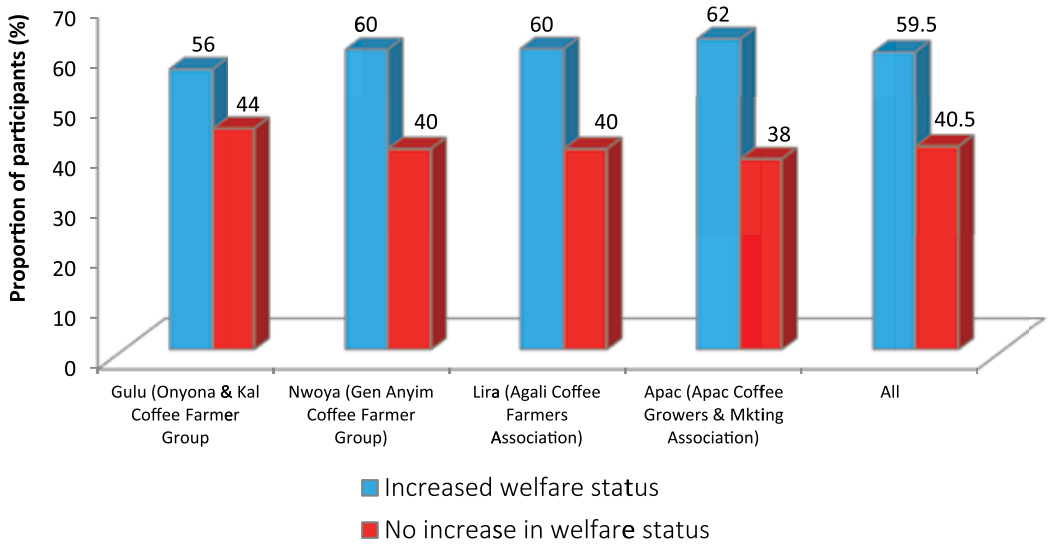
Quantile	Proportion in the distribution (percentile)	UQTE	Confidence Interval (95%)
0.05	5%	0.26** (0.107)	0.0439 - 0.4659
0.10	10%	0.22** (0.109)	0.0036 - 0.4308
0.11	11%	0.19* (0.105)	-0.0116 - 0.3997
0.15	15%	0.13 (0.125)	-0.1170 - 0.3719
0.20	20%	0.07 (0.127)	-0.1776 - 0.3197
0.25	25%	0.07 (0.123)	-0.1731 - 0.3099
0.30	30%	0.05 (0.125)	-0.1971 - 0.2910
0.50	50%	0.05 (0.089)	-0.1252 - 0.2220
0.60	60%	0.04 (0.086)	-0.1303 - 0.2074
0.75	75%	0.02 (0.108)	-0.1894 - 0.2320
0.80	80%	0.01 (0.120)	-0.4898 - 0.2679
0.90	90%	-0.11 (0.193)	-0.4898 - 0.2679
Observations		1718	

Source: Author's computation from UNPS data (2009/10). ***, **, * significance at 1%, 5% and 10% levels respectively; Standard errors are in parentheses under the 3rd column. There is no significant effect of coffee production even in the rest of the upper quantiles (i.e. beyond 0.8). The outcome variable is natural logarithm of per capita consumption expenditure.

5.3.6 Self-reported Direct Welfare Effect from Coffee Farming (Qualitative Evaluation)

The introduction of coffee (as a perennial crop) in mid-Northern Uganda is perceived as a timely development from the perspective of the farmers, district technical staff (technocrats), and political leaders in this part of the country which has been dependent on annual crops (i.e. beans; ground nuts; maize; simsim; cotton; rice; sorghum; sunflower; cassava). Firstly, coffee farmers reported increasing crop diversification because of starting coffee farming, and the introduction of coffee in this part of the country is particularly supporting increased growing of bananas, for the reasons that bananas provide shade to coffee when intercropped. Likewise, UCDA promotes use of bananas which mature quicker than coffee for income enhancement. Respondents (participants) of the FGDs were asked to "self-report" about the impact of being engaged in coffee production on their welfare, based on what they have experienced as coffee farmers. The results are presented in the graph below

Figure12: Self-Reported Observed Responses on Welfare Change from Coffee Growing



Source: EPRC Field Work, March 2014

Overall, about 60% of farmers (Figure 12) reported that coffee production has satisfactorily increased their welfare status (reduced poverty level). The farmers explained why they feel that their welfare level has improved to a satisfactory level and the reason that came out is that coffee production has supported their livelihood through; increasing and stabilizing their income, increased ability to educate their children up to higher institutions of learning (ease in paying school fees), empowering them to construct permanent houses, and acquisition of other household assets (like; land, motorcycle, and livestock such as oxen and dairy cattle among others), better clothing, and better feeding (refer to information Box 2). As alluded to in section 5.3.4, these FGD findings are consistent with the PSM results (ATT) which show that coffee production can significantly reduce poverty through increase in consumption expenditure.

The rest of the farmers (40.5%) reported that they feel coffee production has not changed their welfare status to a satisfactory level; and the reasons advanced included: being new in coffee farming (i.e. young farmers who have just started coffee growing and have not yet harvested and sold coffee); ownership of a few number of coffee trees and low production level; losses arising from damaged coffee trees due to attack by wild bush fire; and crop failure. The reported crop failure was due to use of an area that is not suitable for coffee growing (i.e. stony/rocky garden) and after realizing this problem, the affected farmer(s) are planning to transfer and grow coffee in another field.

5.3.7 Changing Farming System and the Environment

Introduction of coffee in mid-Northern Uganda is creating changes in the farming system in the region for instance farmers have learned how to intercrop coffee with other crops

like; bananas, simsim, beans, and groundnuts among others. Farmers perceive coffee as an essential crop for improving environmental protection. Unlike in the case of seasonal crops where the environment can get destroyed by clearing or opening land on an annual basis, planting coffee requires opening land just once, which instead conserves the environment. In addition, farmers are planting shade trees for coffee (like "albizia" trees) as well as other forms of trees (mangoes, jack fruits, and overcado). This kind of agro-forestry further contributes to environmental conservation. Lastly, as a result of the introduction of coffee farming, some farmers have learned how to do mulching, a practice which farmers are appreciating, since from their experience, constant mulching and proper soil management of the coffee fields is helping them to improve soil quality.

Box 2: Self-Reported Community Level Differences Due to Coffee Farming

Pic 5.2 a: Retired water engineer in a coffee field

Pic 5.2 b: Retired soldier (veteran) depends on coffee field

- High propensity to save; and acces to steady and regular income following coffee harvest cycle; income comes in right (bulk) amounts, and famlies can plan better;
- Coffee is dubbed a **"pension crop".** It is a long term investment on which aging farmers can depend, with minimum labour requirment.
- Faster in taking childern back to better schools. Coffee harvest during the February season concides with annual begining of schooling calender.
- Have a diversified income and income stability; food security; by intercropping coffee with crops like bananas; ground nuts and simsim;
- Buffers income earned from farming against shocks like sickness;
- Enhances social capital and social networks via regular farm tours/hosting of fellow famers/ farmer groups;
- Enables farm households to build permanent houses in a relatively short period

5.3.8 Coffee Output and Sales Thresholds for Poverty Reduction

Further analysis was undertaken to determine the threshold amounts of coffee sales, and resources in terms of acreage and trees an individual in a household requires to move out of poverty (i.e. earn more than the poverty line of $1.25 per day). Table 8c shows that, a farmer producing and selling unprocessed coffee requires 1.4 metric tons of kiboko coffee in a season to move out of poverty[17]. This amount of coffee would enable the farmer to earn approximately 1.2 million Ugandan shillings per annum to be above the poverty line. This would necessitate a threshold of 1 acre or 0.5 acre for farmers who process their coffee and market clean (FAQ) coffee[18]. For a store trader, the threshold amount of coffee traded in a season to live above the poverty line is 2.75 metric tons, based on a margin of Ugx 434 per kilogram (refer to Table 16, section 5.4.7 for details).

Table 8c: Coffee output and sales thresholds

	COFFEE FARMER		COFFEE STORE TRADER
	Kiboko (dry cherries)	FAQ – Value addition	FAQ – Value added
Margin (UG. Shs.)	829	2,214	434
Threshold number of trees	467	268	
Critical volume required per annum (MT)	1.44	0.54	2.75
Threshold acre	1	0.5	
Poverty line	US$ 1.25 a day[19]		

Source: Fieldwork and UCDA regional technical data (March 2014)

5.4 Dynamics in the mid-North Coffee Value Chain

5.4.1 Technology Transfer and Uptake by Farmers

Information pieced together by the research team during fieldwork revealed that the transfer of Robusta coffee technology to the mid-Northern sub-region dates not more than 20 years (as far as 1997). This is based on information from key informants interviewed during fieldwork. The time frame tends to tally with the socio-economic background information on farming experience picked from FGD interviews with farmers (see Box 3 for details). The regional Uganda Coffee Development Authority (UCDA) technical team further alluded to the fact that, at the time coffee was introduced in this sub-region, there was little evidence on

17 The information in table 8c assumes the prevailing coffee market prices and margins per kilogram of March 2014 reported as Ugx 1,500/- for unprocessed coffee, and Ugx 3,650/- for processed FAQ coffee. The threshold acres and coffee trees were derived from lowest equivalent yield of 3 kilograms of kiboko coffee per tree reported in Gulu by the UCDA regional technical field staff.

18 In terms of coffee trees, this requires planting 467 and 268 trees of coffee, respectively.

19 Based on World Bank poverty threshold; and 1 US$ was approximately UG. Shs. 2500 at the time of fieldwork

the viability and performance of coffee in terms of yield and quality. In around 2001, UCDA pilot trials demonstrated that coffee could grow favourably in terms of plant characteristics (plant surface area; leaf size and maturity period); good yield (per tree and or per unit area); quality (in terms of grade and cup taste). These plant characteristics were all found consistent with other Robustas in the traditional areas[20]. This motivated UCDA to roll out the programme supporting more farmers to grow high yield elite (rooted) clonal Robusta coffee which is highly resistant to drought and coffee wilt disease. Currently the UCDA's program for distribution of elite clonal seedling to farming households in the Acholi sub-region for example has grown from about 100 in 2007 to over 1,600 registered farming households in 2014 per annum (Figure 14). The farmers' response to the coffee development program by UCDA has translated into expansion of acreage under coffee annually (Figure 15).

20 The medium term objective was to provide an alternative source of income to the poor people. The long term objective was to sustain Uganda's coffee exports, which was on a downward trend due to the coffee wilt disease in the traditional coffee growing regions (Central, Western and Eastern) since 1993.

Box 3: Coffee Farmers' Self-Reported Socio-Demographic Information

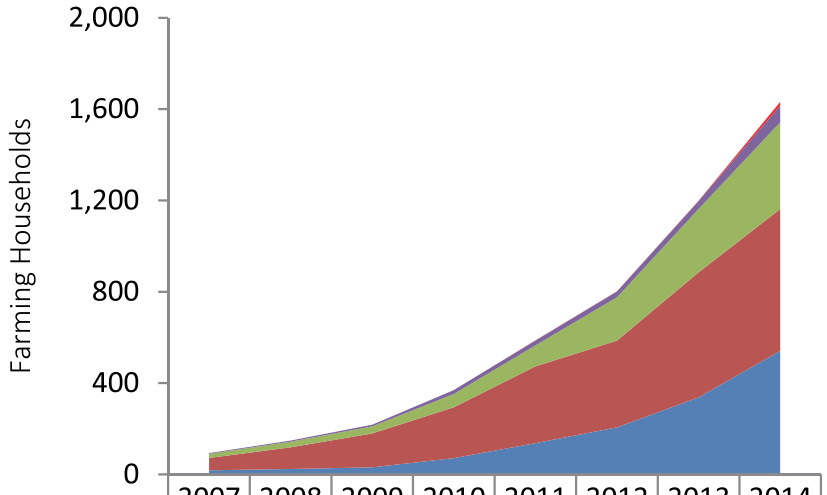
					Socio-Demographic Characteristics - Focus Group Discussion Members								
Group Name	**District**	Membership	**Year Group**					**Age Profile**			**Coffee Growing Experience - years**		
			Started	Registered	Attendance	Male	Female	Mean	Min	Max	Mean	Min	Max
Unyona Kal Coffee Farmers Association	Gulu	25	2004	2004	10	78%	22%	59	26	72	9	3	16
Gen Anyim	Nwoya	27	2010	2010	5	80%	20%	41	35	44	3	2	6
Agali Coffee Farmers' Association	Lira	128	2010	2010	10	70%	30%	58	39	74	10	1	28
Apac Coffee Growers	Apac	125	1997	2006	13	100%	-	48	20	80	14	5	22
Overall profile of FGDs					37	84%	16%	52	20	80	10	1	28

Farmers in attendance during the four FGDs selected from four districts (Gulu, Nwoya, Lira and Apac) in mid-Northern sub-region revealed that within the farmers' groups, experience in coffee farming ranged between one to 28 years, and farmers are aged between 20 to 80 years (Box 3). The information brings some perspectives onto the historical revelations from key informant (both the technical and political leaders)[21] interviews alluding to the fact that coffee is a relatively new perennial crop, first introduced in mid-Northern Uganda by political leaders in 1997 (within the last 20 years). The late introduction of coffee was driven by the need for an alternative to cotton[22]; and to break the overdependence on annual food crops (maize, simsim, and beans); largely attributed to prevalence of persistent low incomes among poor farmers in this sub-region.

Source: EPRC Field Work (March, 2014)

21 These included: district agricultural officers (DAO); district NAADS coordinator; district secretary for production; the chief administrative officers (CAO); RDCs;
22 Cotton had suffered serious setbacks due to falling international prices and uncertainties that followed the liberalization of the cotton sub-sector.

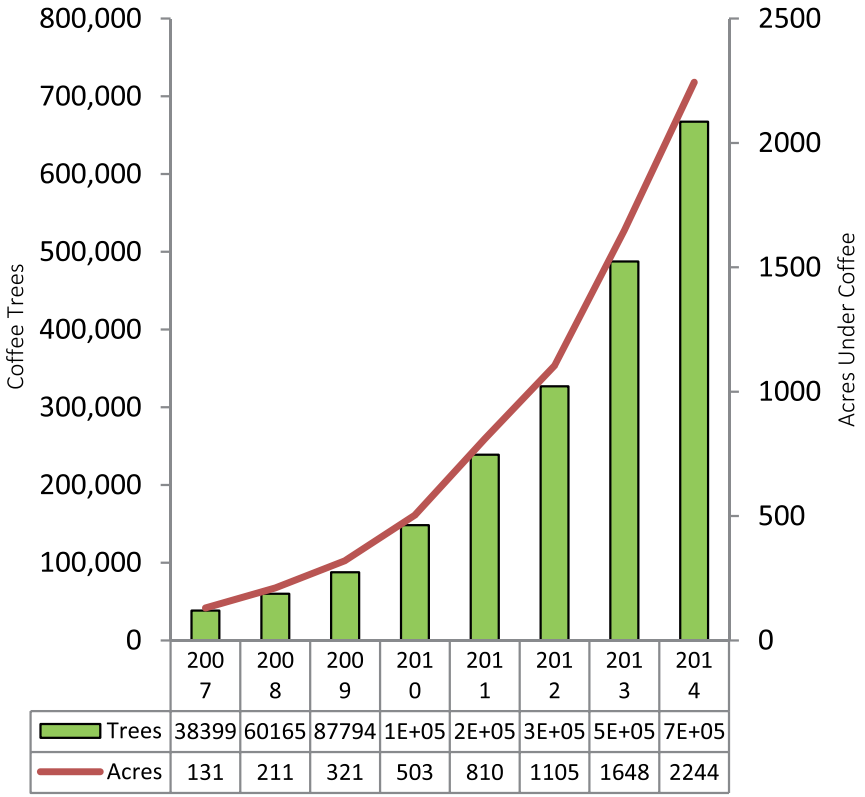
Figure 14: Trend in Coffee Seedling distribution to Households by UCDA



	2007	2008	2009	2010	2011	2012	2013	2014
Lamwo	0	0	0	0	1	1	1	15
Pader	3	5	8	17	21	25	35	74
Amuru	18	24	31	58	92	190	277	380
Nwoya	54	95	148	223	336	380	548	621
Gulu	18	24	31	71	137	206	337	541

Source: UCDA regional Office Data

Figure 15: Growth in Acreage and Number of Coffee Trees in Acholi Sub-Region



	2007	2008	2009	2010	2011	2012	2013	2014
Trees	38399	60165	87794	1E+05	2E+05	3E+05	5E+05	7E+05
Acres	131	211	321	503	810	1105	1648	2244

Figure 16: Size Distribution of known Commercial Coffee Farms by 2012

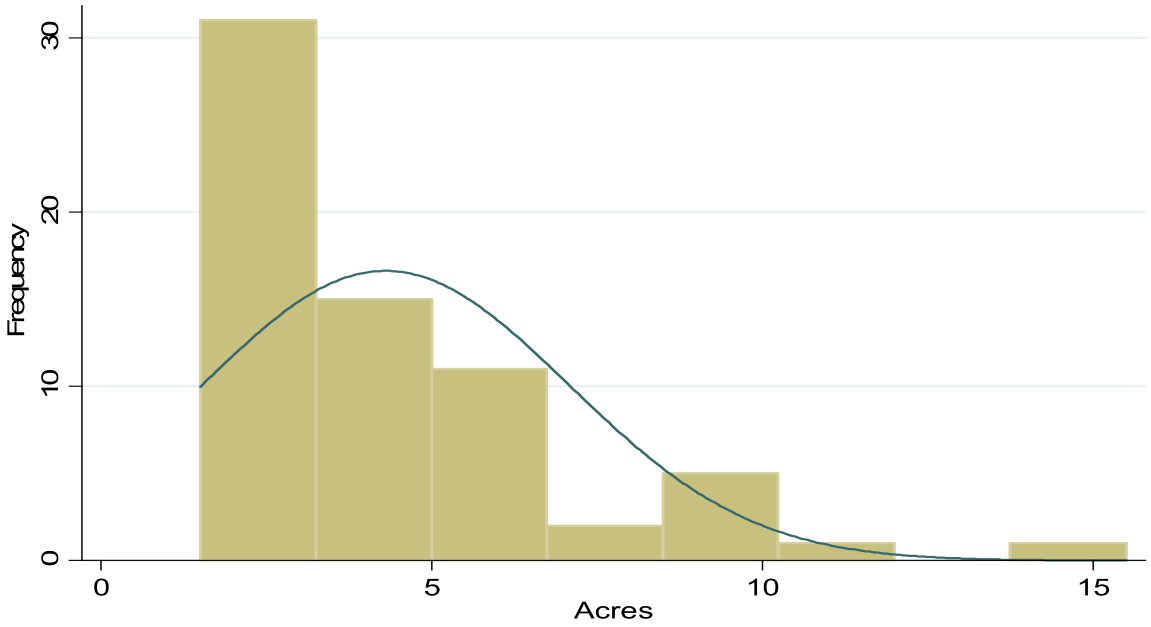
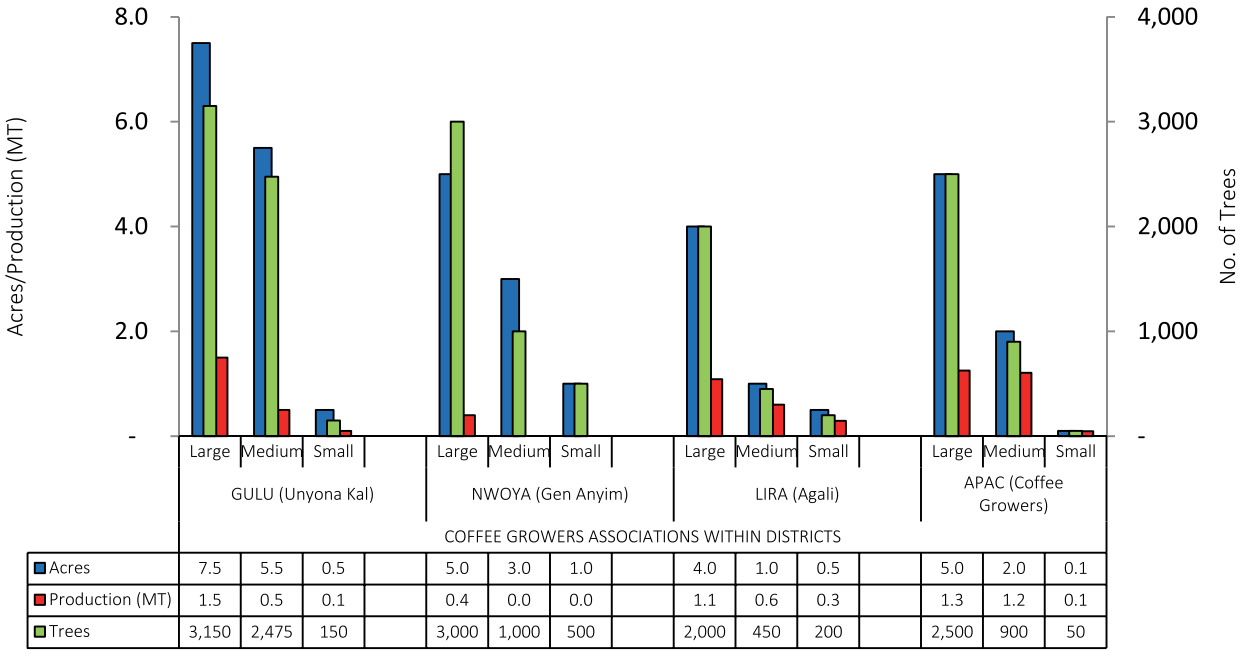


Figure 17: Self-reported Distribution of Coffee Farms



	GULU (Unyona Kal)				NWOYA (Gen Anyim)				LIRA (Agali)				APAC (Coffee Growers)		
	Large	Medium	Small		Large	Medium	Small		Large	Medium	Small		Large	Medium	Small
Acres	7.5	5.5	0.5		5.0	3.0	1.0		4.0	1.0	0.5		5.0	2.0	0.1
Production (MT)	1.5	0.5	0.1		0.4	0.0	0.0		1.1	0.6	0.3		1.3	1.2	0.1
Trees	3,150	2,475	150		3,000	1,000	500		2,000	450	200		2,500	900	50

The 2012 statistics from UCDA regional office on the emerging coffee farms (Figure 16) shows that the majority of registered commercial coffee farms were 2 acres, but some farms greater than 5 acres in size had been established within the mid-Northern sub-region. This compares quite well with distributions of farm sizes among farmers interviewed by the EPRC research team in March 2014 during the FGDs in Gulu; Nwoya; Lira; and Apac districts; where, farmers

categorized farms of; 4-7.5 acres as large, 1-5 acres as medium, and 0.1-0.5 acre as the small coffee farm holdings (Figure 17). This compares well with the national coffee farm holding of 1 acre in the traditional coffee growing regions (Central, Eastern, and Western).

5.4.2 Challenges at Production Level

Farmers during the FGDs identified main constraints in coffee farming (*on a scale of 1 to 5 based on perceived severity*). The importance attached to the severity of the constraints varied across districts (Figure 18), and these included: (i) lack of enough knowledge on coffee growing among farmers (especially by farmers in Apac district); (ii) lack of coffee processing infrastructure - machinery (hullers) to process the dried coffee cherries (Kiboko) to fair average quality (FAQ) – which fetches a high value per unit in the market; and the problem of drought. The problem of marketing infrastructure is jeopardizing the capacity to attract more potential farmers from joining coffee farming. Figure 19 illustrates that a farmer operating at the same capacity earns a margin of Ugx 829 per kilogram without processing; compared to Ugx 2,214 earned per kilogram after processing. Processing increases farmer incomes by almost threefold, therefore it is critically required to add market value, and promote the spirit of collec marketing among the farmers.

Prolonged drought is another major challenge cited by farmers – the drought dries coffee trees, leads to high mortality of newly transplanted seedlings, retards growth of young coffee trees, and flower abortion (Pic 5.3 a). This restricts coffee yield to one season of the year, compared to the two seasons in traditional coffee growing parts of Uganda. Coping mechanism to drought has involved the promotion of agro-forestry (planting *albizia* shade trees). Some farmers have attempted to use low-tech low cost ground drip irrigation methods (see Pictures below – Pic 5.4).

Concerning high maintenance cost over the 2.8 year period before first harvest, the farmers interviewed suggested provision of soft development loans over the 3 years to coffee famers as a buffer for managing the high cost of maintenance of coffee fields during the unproductive period. Other low rated constraints mentioned include: price fluctuations; lack of basic coffee farm equipment (i.e. bow saw for stamping, secateurs used for de-suckering and pruning); rewetting of coffee during storage – associated with using plastic bags during storage; and wild bush fires that decimate coffee fields especially during the dry season.

Figure 18: Challenges in Coffee Farming Rated According to Severity

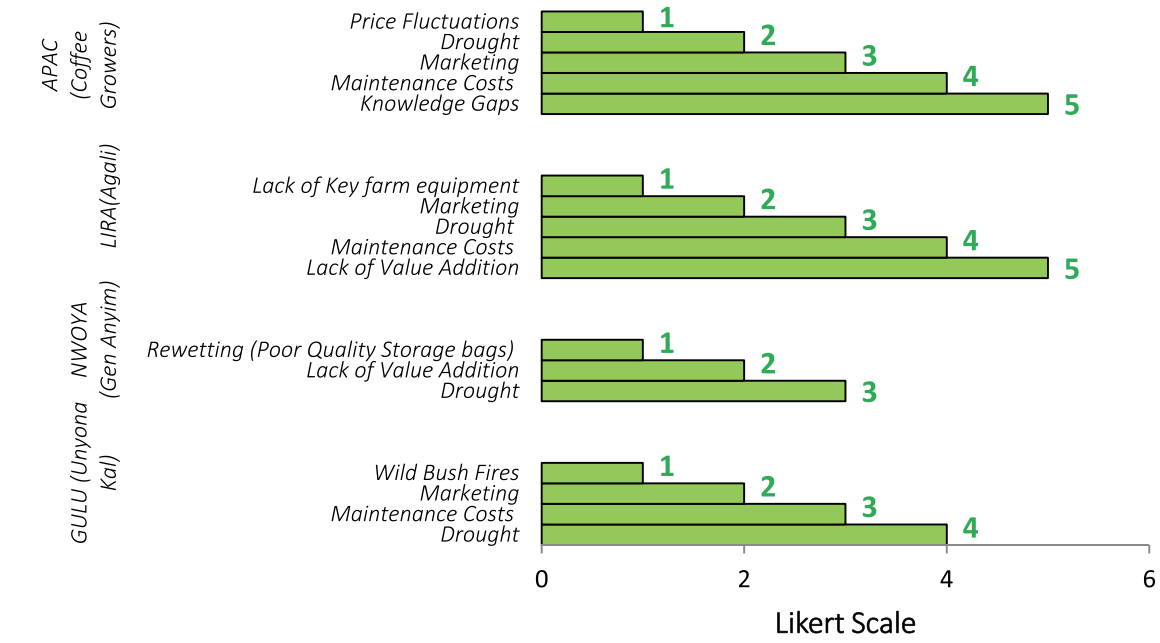
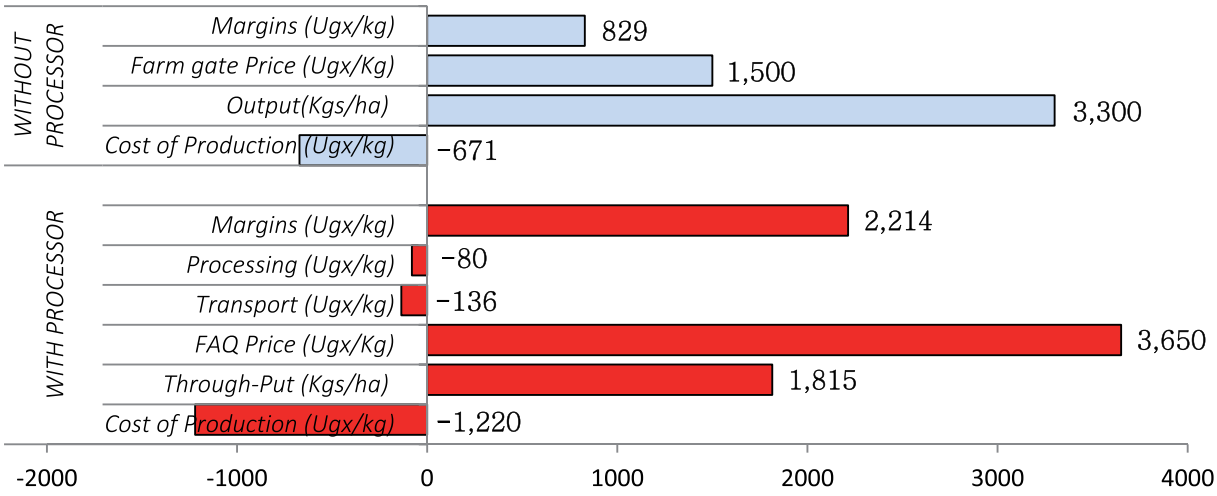


Figure 19: Potential Effect of Processing on Farmer Margins



Source: EPRC Field Work, March

Pic 5.3 a: Drought Stressed Coffee Field

Pic 5.3 b: Intercropping Trees, Bananas and coffee

Pic 5.4 a: Low tech ground drip irrigation in Gulu District

Pic 5.4 b: High tech ground drip irrigation integrated with agroforestry

5.4.3 How the Coffee Seedling Nursery Program Operates

Coffee nursery operators are responsible for propagating certified elite clonal robusta coffee seeds from the mother garden into seedlings, which are distributed to the farmers. The nursery program is managed by both individuals and groups (community-based), contracted by UCDA. Nursery operators are trained by UCDA to manage coffee nurseries, and receive on average 5 to 10 kgs of certified elite seeds free of charge from UCDA. After raising seedlings in the nursery beds for about 6-8 months, the operators distribute the coffee seedlings to farmers based on the seedling annual allocation (quotas) by UCDA and in return, UCDA pays Ugx 300 per seedling distributed.

For the community based nurseries, UCDA identifies existing community farmer groups that are interested in coffee farming, and trains them (both the newly formed and existing groups) in coffee nursery management. Community nurseries raise seedlings and distribute them amongst individual members based on interest. In case of surplus seedlings from group nurseries, UCDA intervenes and procures the seedlings for non-members within the same locality, and the proceeds are ploughed back to the group for running group activities, supporting coffee farming, and lending amongst the members.

By the time of this study (March 2014), 132 UCDA supported seedling nurseries were reported across the 14 districts in the mid-Northern sub-region (Table 1G, Appendix G).The coffee nurseries are characteristically “low cost low input” units that have effectively been used by UCDA in partnership with the farmers (private sector) to support the coffee introduction program in mid-Northern Uganda. The low cost nursery units are established using local poles, grass, and family labour (See Pic 5.5); which makes them easy to manage and affordable to operators to effectively distribute seedlings in the sub-region. This arrangement has ensured that seedling production and distribution services are moved closer to the farmers at sub-county level[23].

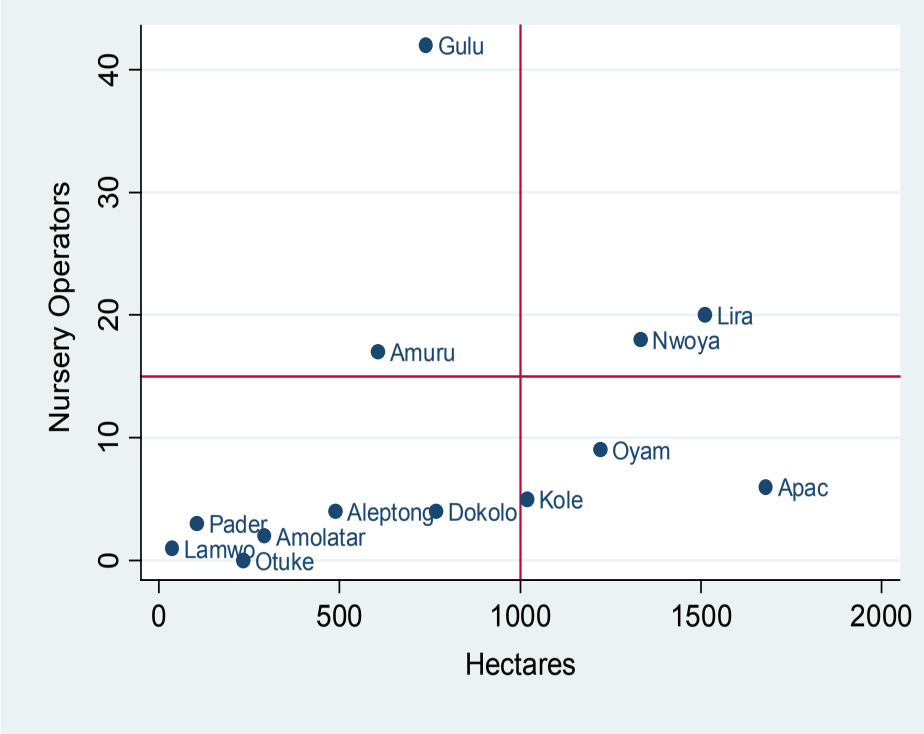
5.4.4 Outcome from Coffee Seedling Nursery Operators Programme

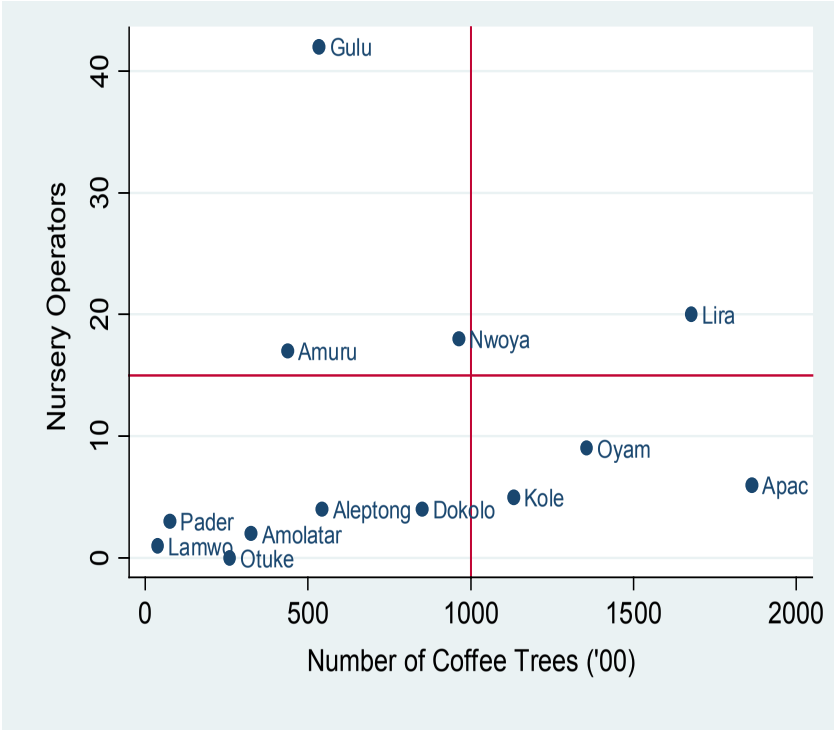
The research team analyzed the resultant impact of the coffee seedling multiplication and distribution program (Figure 20) measureable in terms of: (i) hectares under coffee; and (ii) number of coffee trees established. Results reveal a systematic success in the 5 districts of Lira, Nwoya, Oyam, Kole, and Apac. Accordingly, these districts have high potential for coffee production in the sub-region. The high potential is associated with low mortality rate of the seedlings in nurseries and the numbers of surviving trees as reported in Figure 20. In the rest of the districts, there is low potential of coffee production as reflected by the low numbers of nursery operators as well as cumulative coffee trees planted over the years.

23 This however creates some risks into the system in that - failure of a nursery in a given sub-county could jeopardize the coffee expansion programme in the entire sub-county, since one sub-county has only one nursery operator.

Pic 5.5: Low Cost-Low input Clonal Coffee Nursery Unit

Figure 20: The distribution of nursery operators and Resultant effect (Hectares, Coffee Trees) in the mid-Northern Uganda





5.4.5 Challenges with Coffee Seedling Multiplication and Distribution.

The different methods of seedling propagation, and challenges associated with them are discussed in this sub-section. The field survey discovered an inconsistency in the propagation of the seedlings using F2 seeds, against the recommended practice of using FI elite seeds from the mother garden of 6 clonal robusta lines as illustrated in Figure 21. This is being done by 3 seed operators contracted by UCDA, probably in attempt to meet the current demand for the sub-region. The production capacity of Ngetta mother garden, at 750 kilos of seeds, is below the estimated capacity for the sub-region estimated at 1500 kilos of elite seeds (UCDA estimates). Using the F2 seeds will produce the F3 coffee product which could be less consistent in terms of quality and yield attributes as F1 product from the mother garden.

The recommended practice is using the F1 elite seeds from the mother garden (Figure 22); where F1 seed are produced from a cross pollination of 6 clonal lines in the mother garden; which is procured by UCDA and given to nursery operators for seedling multiplication. Farmers then plant the F1 seedlings and produce F2 product which has been proven characteristically consistent with the F1 product in terms of; yield, disease resistance, and quality (grade and cup taste).

This assessment would suggest that in order to have consistency in F1 elite seed production for the sub-region, UCDA, together with the coffee research institute (CoRI) should endeavor to expand the capacity of Ngetta mother garden, to produce adequate elite robusta seed for seedling propagation. Other challenges to nursery development are detailed in Box 4.

Figure 21: Observed Practice

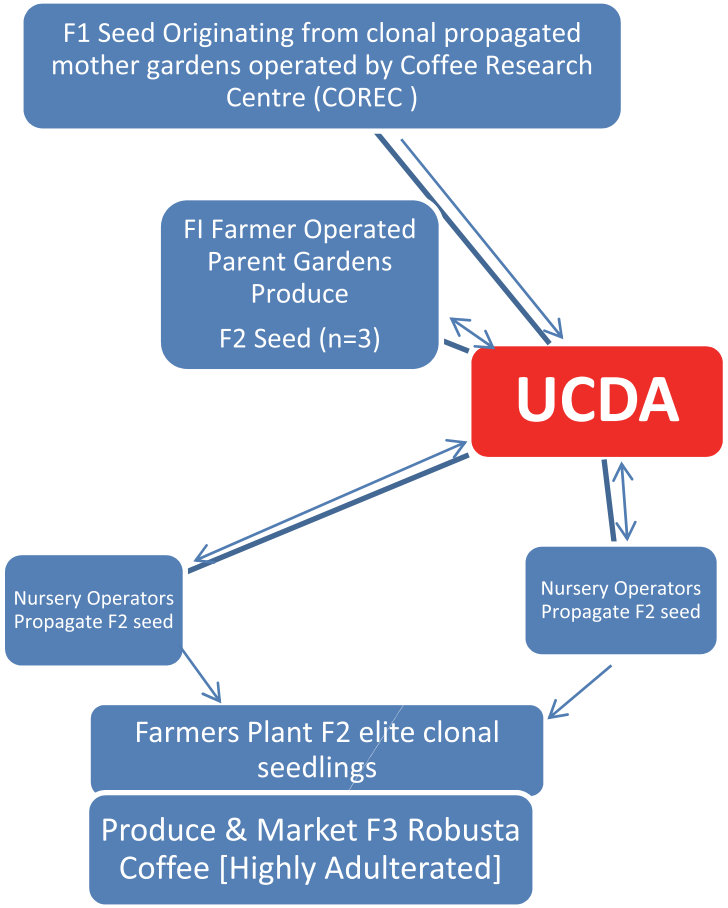
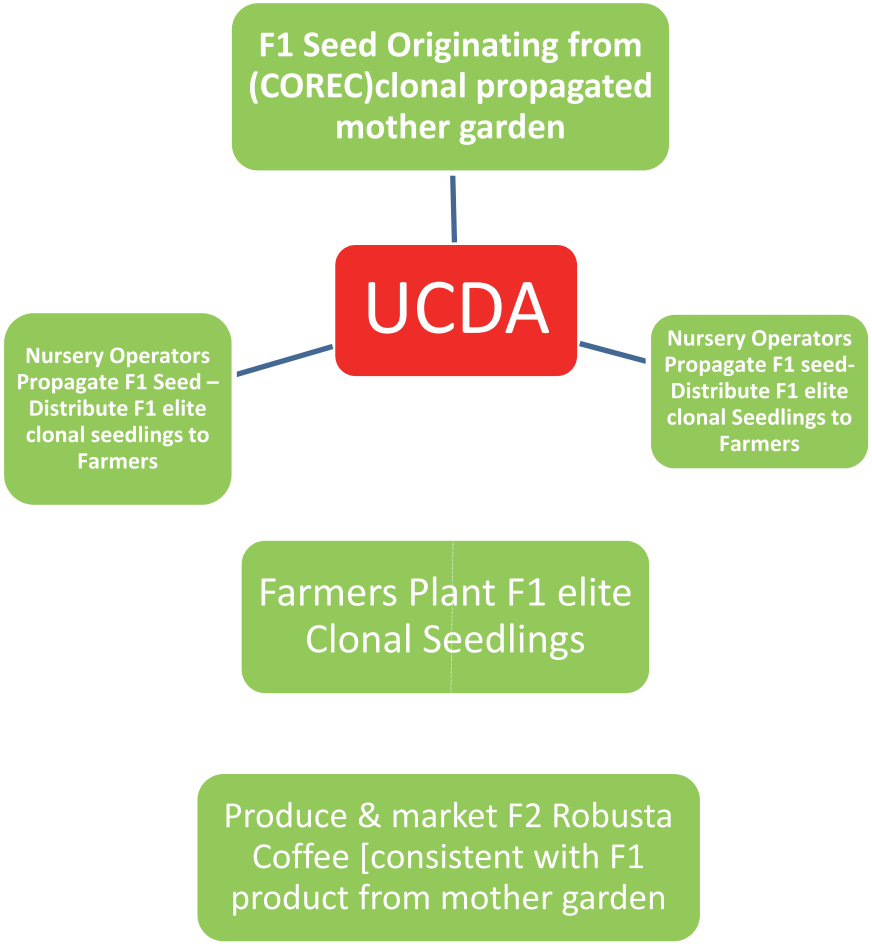


Figure 22: Best Practice



Box 4: General Nursery Operators' Challenges

Operationally, the nursery operators experience the following identified challenges:

- **Insufficient pots:** The potting materials that are provided by UCDA to the nursery operators are not enough.

- ***Limited Market for Seedlings:*** Sales are still limited to UCDA allotted quotas to farmers. A viable private sector seedling market has not yet emerged in this part of the country, leading to limited demand for seedlings. More so, some farmers are not aware of the availability of coffee seedlings. Those who are aware still wait for the free UCDA allocations.

- ***Low seedling quota offered by UCDA:*** The allocation of seedlings for purchase by UCDA for distribution to farmers is lower than the number of seedlings raised by nursery operators. Due to the mismatch between UCDA allocation and seedling production, the operators therefore distribute fewer seedlings compared to what they produce and yet operators complain that maintenance of the remaining seedlings is costly occasioned by the need for regular watering. If not distributed in the subsequent season, the remaining seedlings get damaged.

- ***Delayed payment by UCDA:*** The UCDA does not make prompt payments for the seedlings raised and distributed by nursery operators. Payments are delayed over a period of about one year on average, and this is affecting all the coffee nursery operators since they all distribute the seedlings based on quotas that UCDA pays for. This is a big disincentive to nursery operators as far as seedling production is concerned. In addition to delay in payment, some operators receive late orders for seedlings from UCDA, which affects their seedling distribution plan.

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- ***Inadequate water:*** Sometimes water from available sources (like the well) dries up, especially during dry spells which makes watering of the nursery bed very difficult, and some of the seedlings get damaged or dried up – this therefore necessitates employment of appropriate (simple) irrigation technologies. Nursery operators also lack equipment such as; rakes, wheelbarrows, and spades among others.

- ***High labour requirement:*** The labour requirement for filling the pots is costly for the operators, given that they lack enough financial resources to fund the operation of nurseries, and this problem is heightened by the long delays in payment for the seedlings distributed to farmers.

5.4.6 Level of Uptake of Purchased Inputs

The research team investigated the level of uptake of other purchased inputs by coffee farmers in the mid-Northern sub-region, and business developments supplying such inputs. The investigation zeroed down on the input-stockist – the key actors in the supply of other purchased inputs. These are "general dealers" who do not trade specifically in coffee inputs, but deal generally in other agro-inputs. The volume of business in coffee related inputs is not pronounced; and the input dealers interviewed attributed this to the fact that coffee is still a relatively new crop in the area. Nevertheless some farmers have started to purchase inputs related to coffee like; non-selective herbicides for land clearing, selective herbicides for weeding, pesticides/fungicide (like; rondazan, tuff go, fern kill, copper chloride), organic fertilizer, and watering cans, and some fertilizer. This is a demonstration that coffee production like in the other traditional coffee regions of Uganda (central; eastern and south-western Uganda) is under a low input system. Therefore, increased efforts for promotion of input use by farmers (especially fertilizer) are required, in order to improve coffee productivity in the region, and country wide, to strive towards the Vietnamese milestones.

5.4.7 Primary Coffee Trading Activities

The prevailing raw coffee market in mid-Northern Uganda is still highly informal. Farmers sell kiboko (dry coffee cherries) directly to itinerant primary kiboko coffee traders (who move door to door), bulking the small volumes from smallholder farmers. The roving traders (reported to have an upper hand in price determination), come mainly from the central and mid-Western districts of Luwero and Masindi with fairly developed processing infrastructure (factories with hullers). There is no established network of kiboko coffee store buyers and hulling factories, for bulking, marketing and processing coffee within the mid-Northern sub-region. Farmers' primary marketing activities remain scattered, and the district based coffee traders have to run up and down looking for coffee which creates marketing challenges, especially when it comes to pricing, quality control, and post-harvest handling[24]. There is however some evidence of facilitated coffee trading by the UCDA and district local government agricultural technical staff (Pics 5.5a, 5.5b & 5.c).The coffee value chain in mid-Northern Uganda can be strengthened if support is provided to establish store buyers and processing plants. Such marketing infrastructure would ensure steady flow of coffee from farmers to the factories and to the exporters at market based prices. The EPRC team interviewed one of the store traders who buys coffee within a radius of 15 km and his costs and margins are shown in Table 9

24 Poor storage brings about rewetting of the dry cherries. Hoarding coffee in anticipation of good prices sometimes compromises the quality of coffee due to poor storage facilities. It also makes business to be seasonal and slow during the year, particularly around June – October. Lack of post-harvest handling knowledge requires that coffee has to be re-dried by the trader after purchase from farmers, as a result of knowledge gap on the side of farmers regarding handling coffee after harvest, including bad storage facilities. This is demanding in terms of labour, and compromises the quality of coffee for sale.

Table 9: Trader Margins in Mid Northern Uganda (2014)

Item		Unprocessed 'Kiboko' Coffee	Processed Fair Average Quality (FAQ) Coffee
Volume Purchased (MT)	A	15	8.25
Buying Price (UGX/Kg)	B	1500	2,727
Selling price (UGX/Kg)	C	-	3650
Transport (UGX/Kg)	D	-	136
Processing (UGX/Kg)	E	-	80
Overheads (Contingency 10% of B)	F=10% of B	-	273
Margins (UGX/Kg)	G=[C-B-D-E-F]	-	434
Gross Profit	H=[G*A]100	-	3,580,500

Source: EPRC Field Work (March 2014)

Pic 5.5a: Coffee Store Trader in Lira District

Pic 5.5b: Coffee Bulking at the UCDA Northern Uganda Coordination Office

The trader in Pic 5.5a above, reported to have purchased and bulked 15 metric tons of kiboko coffee in the October 2013-February 2014 season. This earned her a gross profit of Ugx 3.5 million (Table 5.6). Potentially the 154 metric tons recorded coffee output can support 10 business enterprises of "store traders" with capacity to buy 15 metric tons of kiboko coffee in a 6 months season (October to February). Likewise, according to the UCDA technical staff interviewed, the 154 metric tons current production can viably support the operation of run 3 – one huller coffee processing factories within mid-Northern Uganda.

This further illustrates the income (poverty) effect that the coffee industry may have to other actors along the value chain.

Pic 5.5c: Bulking Coffee at Lira MAAIF local government Offices by Technical Staff

6. Potential Economic Implications of Coffee Expansion in the Mid-North

6.1 Potential Impact of Expanded Coffee Production

The introduction of coffee in the Mid-Northern sub-region seems to be succeeding in terms of crop viability, productivity and farmer uptake. Cumulatively since 2000, the number of coffee farmers is 15,887 in the entire sub-region (Table 10). Going by the UCDA figures (Table 3, section 5.2 and Table 10), output in coffee season 2012/13 was 154 metric tons (equivalent to 86.24 metric tons of clean equivalent at out-turn of 56 percent). However the potential output is about 16,323 metric tons (derivable from annual yield of 3,000 kilos per hectare from 9,070 hectares adjusted to 5,442 hectares at survival rate of 60% of planted trees (Table 10)[25]. It is implied here that a larger proportion of coffee that has cumulatively been planted since 2011/12, is yet to come in full production if we take into consideration the 4 year gestation period for improved robusta coffee to reach peak production levels.

The revenue from 154 tons (realized in coffee season ending in 2013) from the mid-North sub-region is estimated at about 0.2 million US dollars. The estimated output is 16,326 metric tons projected by 2017/18 (Table 10). This would be 11,567metric tons of clean equivalent; valued at 20 million USD (Table 11). This amount of revenue would have significant economic implications to both household poverty and the national economy in terms of foreign exchange. If we consider what the country has invested through UCDA, estimated at about Ugx 200 million (0.08 million US dollars) per year in terms of seedlings, banana suckers, seed development, and human resources, in the last ten years, this was a worthwhile investment and must be intensified. Full realization of the 20 million USD will be after three years of gestation period for a coffee tree by 2017.

25 Coffee has a gestation period of 4 years to get to peak production. Most (70%) of coffee in mid-Northern Uganda were planted around 2011/12 – 2013/14 peak (potential) production (Table 10; column f) would be realized by 2017/18.
It should be noted that the wide gap between the actual and potential coffee output in the mid-North sub-region is due to the lag (gestation) period between planting and first average stable yield realized in the fourth year after planting. Although the first yield is realized during the third year after planting, it is always a small crop that constitutes about 25 percent of the potential average harvest.

Table 10: Current and Potential Production, Acreage and Output in mid-Northern Uganda

DISTRICT	Number of Trees	Hectares			Production (MT)		Farming Households
	a	Derived[26]	Net[27]	Reported	Current	Potential[28]	
		b	c	d	e	f	g
Lira	1,677,624	1,511	907	1,511	29	2,720	2,512
Apac	1,864,028	1,679	1,008	1,679	33	3,023	2,253
Oyam	1,356,310	1,222	733	1,222	21	2,199	1,989
Kole	1,131,505	1,019	612	1,019	9	1,835	1,398
Dokolo	851,289	767	460	767	4	1,380	1,116
Aleptong	543,278	489	294	489	3	881	727
Amolatar	325,000	293	176	293	3	527	566
Otuke	259,600	234	140	234	-	421	236
Kaberamaido	8,800	8	5	7	-	14	44
Gulu	533,812	481	289	739	13	866	1,334
Nwoya	963,202	868	521	1,333	25	1,562	2,408
Amuru	438,165	395	237	606	11	711	1,095
Pader	76,635	69	41	106	4	124	191
Lamwo	38,285	34	21	38	-	62	18
Total	**10,067,533**	**9,070**	5,442	**10,045**	**154**	16,326	**15,887**

26 The derived hectares (column b) are computed using a conversion factor of 1110 trees per hectare (i.e. column a divided by 1110).
27 The net number of hectares is derived at 60% survival rate of trees in the mid-North as reported by the regional UCDA staff.
28 Potential production (Column f) is imputed based on the recorded productivity in the mid-Northern sub-regional output of 3,000 kilograms per hectare (i.e. column b multiplied by 3,000; divided by 1000).

Table 11: Projected Coffee Output and Revenue from mid-Northern Uganda by 2017/18

Sub-region/ production parameter		Acholi	Lango	Total
Cumulative number of farmers	A	5,046	10,841	15,887
Cumulative trees planted	B	2,050,099	8,017,434	10,067,986
Net tree stock (survival rate of 60%)	C=[Bx0.6]	1,230,594	4,810,460	6,841,054
Net area in hectares (at 1,110 trees/ha)	D	1,108	4,333	5,441
Current production in MT	E	53	101	154
Projected production in MT *per ha.* per year	F=[D*3000]/1000	3,324	12,999	16,323
Equivalent production in MT of Clean coffee at out-turn (56%) in MT	G=[F*0.56]	1,861	7,280	11,567
Current Revenue estimates (million US$)	H	0.065	0.124	0.190
Estimated foreign exchange revenue[29] at peak production (million US dollars)	I	4.1	16.0	20.1

Source: Author's computation based on UCDA (2013) regional office Figures

Table 12: Projected Revenue from continued UCDA Clonal Coffee Seedling Distribution Program 2018- 2021

Intervention and Outcome	2014	2015	2016	2017	2018	2019	2020	2021
UCDA Supported[10] annual Seedlings Planting (millions)	3	3	3	3	3			
Cumulative planting (millions)	3	6	9	12	15			
Cumulative area (ha) –New coffee	1,621	3,242	4,863	6,484	8,105			
Production (Kiboko) MT				4,863	9,726	14,589	19,452	24,315
Clean Equivalent coffee (metric tons)				2,723	5,447	8,170	10,893	13,616
Revenue (million USD)				6	12	18	24	30
Revenue from old Stock (million USD)					20	20	20	20
Overall revenue effect (million USD)					32	38	44	50

Source: Author's computation based on UCDA (2013) regional office Figures

29 International price level 2012/13 coffee year - at 2200 US$ per MT of clean coffee

Table 13: Investment Required to Meet the 2014-2021 Projected Output Levels in mid-Northern Uganda

Type of Investment	Units	2014	2015	2016	2017	2018	2019	2020	2021	Estimated Total Investment
1. Nursery support (Ugx m)	300 nurseries@ Ugx 1.13 m	339.75	339.75	339.75	339.75	339.75	-	-	-	1,699
2. Seed procurement (Ugx m)	1,500 kgs (elite Seed) @ Ugx 7,000	10.5	10.5	10.5	10.5	10.5	-	-	-	53
3. Seedling Procurement (Ugx m)	3 million seedlings @ Ugx 300	900	900	900	900	900	-	-	-	4,500
4. Processing infrastructure:	3 (one huller factory) @ Ugx 40 million	120					-	-	-	120
5. Market infrastructure:	10 Stores @ 10 million Ugx	100					-	-	-	100
6. Strengthen farmer groups	45 groups 3 @ district	225	225	225	225	225	-	-	-	1,125
7. Extension Support	50 staff @ Ugx 500,000/quarter	100	100	100	100	100	-	-	-	500
	Grand Total	1795.25	1575.25	1575.25	1575.25	1575.25	**-**	**-**	**-**	**8,096 Billion Ugx**

Source: EPRC (May, 2014) Field Work Data

6.2 Potential Export Revenue Earnings

This section provides a simple simulation analysis of the potential revenue earning to the economy if UCDA consistently supported the coffee programme in the mid-North sub-region for the next 5 years (2014-2018); supplementing the already planted net tree stock of 6.8 million trees planted in the 5442 hectares (Table 11). Simulations (Table 12) show the outcome if UCDA maintains support of planting 3 million seedlings annually between 2014 and 2018. Over the five year period, the programme would yield about 15 million trees by 2018 (see Table 12), equivalent to a net of 9 million trees (8,108 hectares)[30] at a survival rate of 60 percent by 2018.

A total of 24,324 metric tons of Kiboko (clean equivalent of 13,621 ton)[31] is projected to be produced in the region by 2021. The projected revenue from this coffee (at USD 2,200 per metric ton - 2012/2013 coffee year price) is about 30 million USD, by 2021. If we factor in the $ 20 million as revenue from the output of the 2014 old coffee that would reach maximum yield in 2017; total annual projected revenue from export of coffee from mid-Northern Uganda will be at about $ 50 million dollars, from the year 2021[32].

This amount of revenue to the country has a lot of implications to poor household's incomes and poverty, as well as to the national revenue (foreign exchange earnings).

6.3 Implied Cost of Investment

To achieve anticipated growth and outputs (through coffee) in the economy over the period of 2014-2021, the basic requirements will include:

i) Continued support to nursery development;
ii) Continued seed purchase for nursery operators;
iii) Continued support to planting coffee;
iv) Support the development of marketing and processing infrastructure;
v) Strengthen farmer groups for bulk marketing and processing of coffee; and
vi) Strengthen coffee specific extension services among agricultural district extension workers and Non-Governmental Organizations (NGOs).

Information in Table 13 shows that an estimated total investment of about Ugx 8.1billion ($ 3.2 million) over the five 5 years (2014-2018) would be required to achieve the projected coffee output from the mid-Northern sub-region. This amounts to Ugx 1.62 billion per annum on average; and the estimated resultant outturn from the investment is $50 million annually. The UCDA 2012/2013 annual budget and work-plan shows that UCDA can only meet about

30 The conversion factor is 1,110 coffee trees in 1 hectare.
31 The average yield per hectare per year of about 3,000 kilos of Kiboko per hectare is assumed; at out-turn of 56 percent from Kiboko to clean coffee.
32 Assuming prices remain at USD 2,200 per metric ton 2012/2013 coffee year prices

30 percent (Ugx 500 million) of the estimated annual investment requirement. This would imply that to realise the full potential of coffee production in the sub-region, complementary investment efforts by government and other development projects are important.

Uganda's option to increase export revenue lies in expanding production. Since 1964, variations in export earnings to the country have been majorly determined by changes in the international unit prices with minimum production responses (See Appendix I, Figure 1I). Therefore the country needs to invest in coffee programmes to expand production in the non-traditional coffee growing areas like northern Uganda, and intensification in the traditional coffee growing areas as long as the unit costs of production at farm level remain lower than the international prices.

Trends in international coffee prices have shown favourable cyclic movements (low source of risk), which Uganda has not taken advantage of to increase production and maximize foreign exchange revenue. On examining the relationship between export earnings, and international unit price (See Appendix I, Figure 1I), it is evident that there has been weak policy responses from government to expand coffee production. The direction government is taking to expand coffee production in the mid-Northern sub-region is timely.

7. Conclusion and Policy Recommendation

7.1 Conclusion

The coffee programme piloted by UCDA at first (around 2001) and subsequently rolled out as a programme, has demonstrated that coffee has a potential in the mid–Northern sub-region for household poverty reduction. More importantly, findings indicate that coffee production is a pro-poor intervention. This builds from a national wide impact evaluation using propensity score matching and distributional impact analysis methods, on the impact of coffee on poverty and factors motivating its production. Field survey findings confirm that the factors on the ground are consistent with other traditional areas to favor coffee adoption and expansion in the sub-region. The programme has yielded a cumulative net total area of about 5441 hectares of coffee, currently producing 154 metric tonnes of kiboko (86.24 metric tons of clean coffee at 56 percent out-turn); with a potential 16,000 metric tons of kiboko (9000 metric tons clean equivalent - 56 percent out-turn); and foreign exchange revenue of about 20.11 million US dollars.

UCDA has been the lead agent of change in the transfer of coffee technology in the sub-region. This has been through working in partnerships with low cost-low input elite seed nursery operators, currently standing at 132 in number (as of March, 2014). The nursery operators have been key actors in the distribution of elite clonal robusta seedlings across the 14 districts in the sub-region.

The study observes wide variability in coffee production across 16 districts in the mid-North sub-region relatively, and identifies Apac; Lira; Nwoya and Oyam as high potential coffee producing districts. As regards production thresholds for individuals and households to move out of poverty in this part of the country – the study results reveal that a farmer as an individual requires producing and selling 1.4 metric tons of kiboko (unprocessed) coffee in a season to earn about Ugx 1.2 million per annum as a threshold to move out of poverty. This would necessitate a threshold of 1 acre of coffee planted, and 0.5 acre, for farmers who market unprocessed and processed coffee respectively. In terms of coffee trees, this requires planting 467 and 268 trees of coffee, by farmers who do not process and process coffee respectively. This implies that a household of six adults on average would require a minimum of 3 acres of coffee (with processing) to get out of poverty.

The study identifies the following challenges at the production level: Lack of an organized marketing, storage and processing infrastructure for value addition. There is also low level of understanding and application of the recommended agronomic practices by majority of farmers. In relation to seed multiplication, there is limited capacity to produce the recommended F1 elite clonal coffee seeds for propagating the seedlings at Ngetta regional clonal mother garden in Lira district. This has necessitated UCDA to contract the 3 elite seed producers, against the recommended FI elite seeds for consistent coffee quality product for the export market.

7.2 Policy Recommendations

The coffee growing program needs to be intensified in mid-Northern Uganda to fight poverty among the poor households. Apparently coffee is still ranked variably low by farmers (i.e. *fifth,* sixth, and *seventh) as a* cash crop within the sub-region. It is recommended that UCDA with complementary government support and other development projects consolidates coffee development in the sub-region in the following areas:

- Continued support to nursery development at a planting rate of 3 million seedlings annually in the next five years (2014-2018). This would require purchasing F1 seeds for propagation by nursery operators. It is envisaged that over the five year period this would increase coffee production by an additional 15 million coffee trees (8,108 hectares at 60% survival rate) by 2018. This would culminate into 24,324 metric tons of kiboko (unprocessed coffee); and 13,622 metric tons of exportable clean coffee valued at $30 million per annum from the year 2021.
- We note that coffee processing increases farmer margins from Ugx 800 to over Ugx 2000 (more than double). It is therefore advisable that processing is done to add market value, and promote collective coffee bulking and marketing of farmers' coffee. The support would initially require establishment of 3 factories and about 10 stores through the private sector, which could eventually be expanded. The districts of Nwoya; Lira and Apac, have high potential for collective coffee marketing and processing and should therefore be targeted.
- Additional support is required to strengthen coffee specific extension services through existing UCDA extension system and building the capacity of the existing local government extension staff on improved coffee management practices.
- Threshold trees that can enable an individual within a household to move out of poverty lies between 250 (0.5 acres) and 500 (1 acre) trees. Therefore, a meaningful seedling program should aim at achieving these targets at individual level.

To achieve the above necessary investment in the coffee industry in mid-Northern Uganda would require an estimated total investment of about Ugx 8.1 billion ($ 3.2 million) over the five 5 years (2014-2018). This amounts to Ugx 1.62 billion ($0.65 million) per annum on average; and the estimated resultant outturn from the investment is $30 million annually by 2021.

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APPENDICES

APPENDIX A:

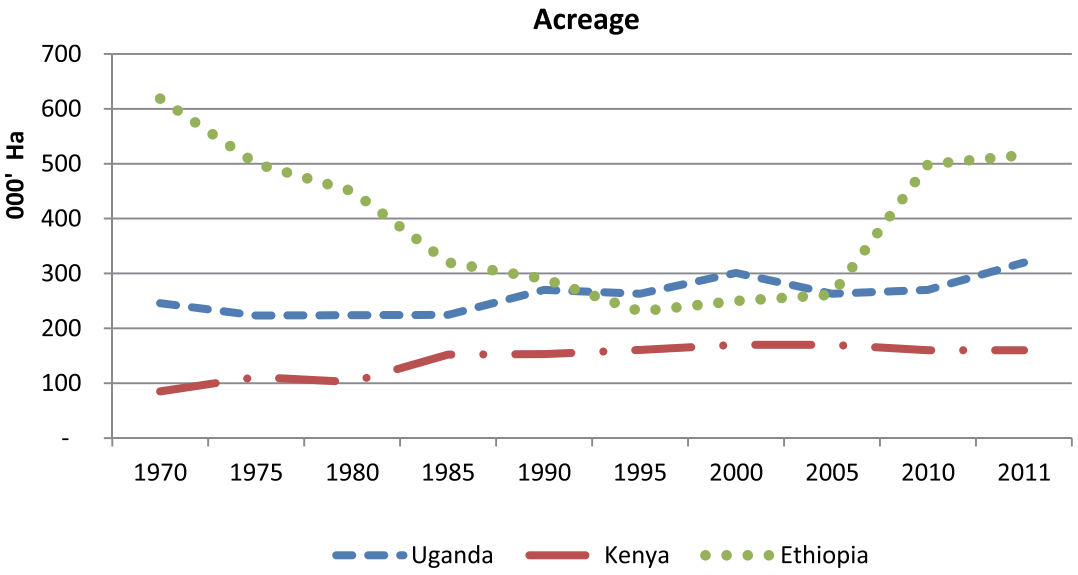
Table 1A: Total coffee production and acreage for selected countries (2000 – 2011)

COUNTRY	PRODUCTION (Tonnes)	AREA (Ha)
Brazil	28,632,761	27,306,948
Vietnam	11,612,957	5,921,365
Ethiopia	2,351,674	3,439,429
Uganda	2,104,076	3,333,495
Kenya	629,302	1,988,000
Burundi	258,292	277,200
Rwanda	224,452	361,332

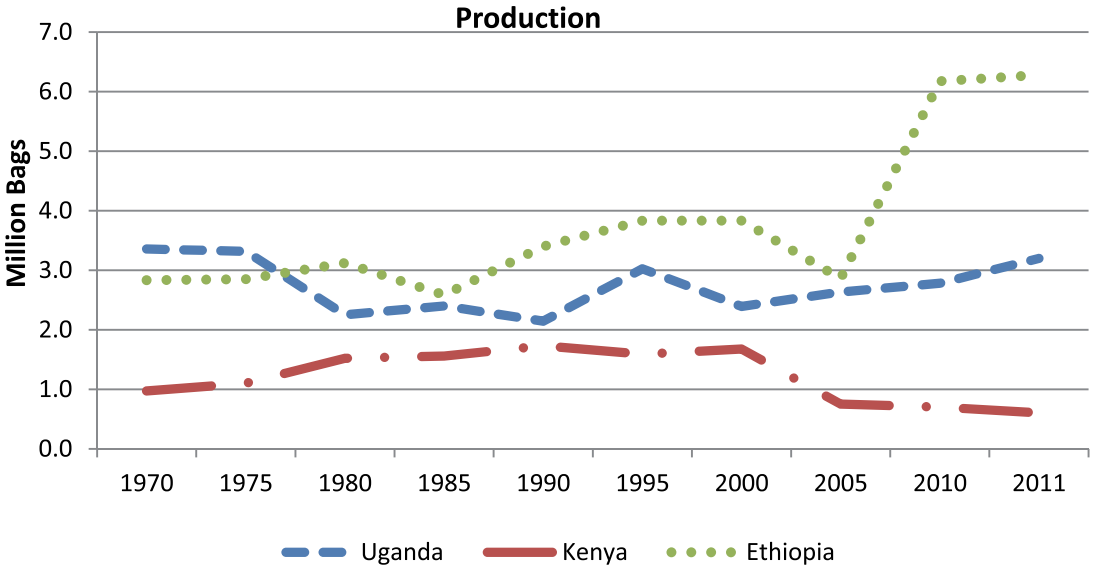
Source: FAOSTAT (2013). Ethiopia's data for 2011 not included.

APPENDIX B

Figure 1B: Performance of the Coffee Industry in Uganda, Kenya, and Ethiopia

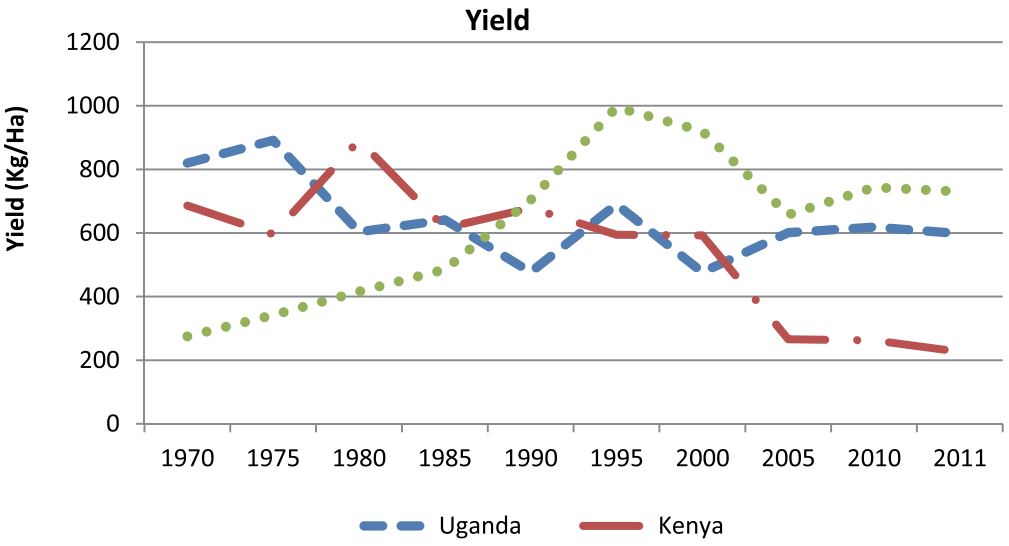


Data source: FAOSTAT (2014)

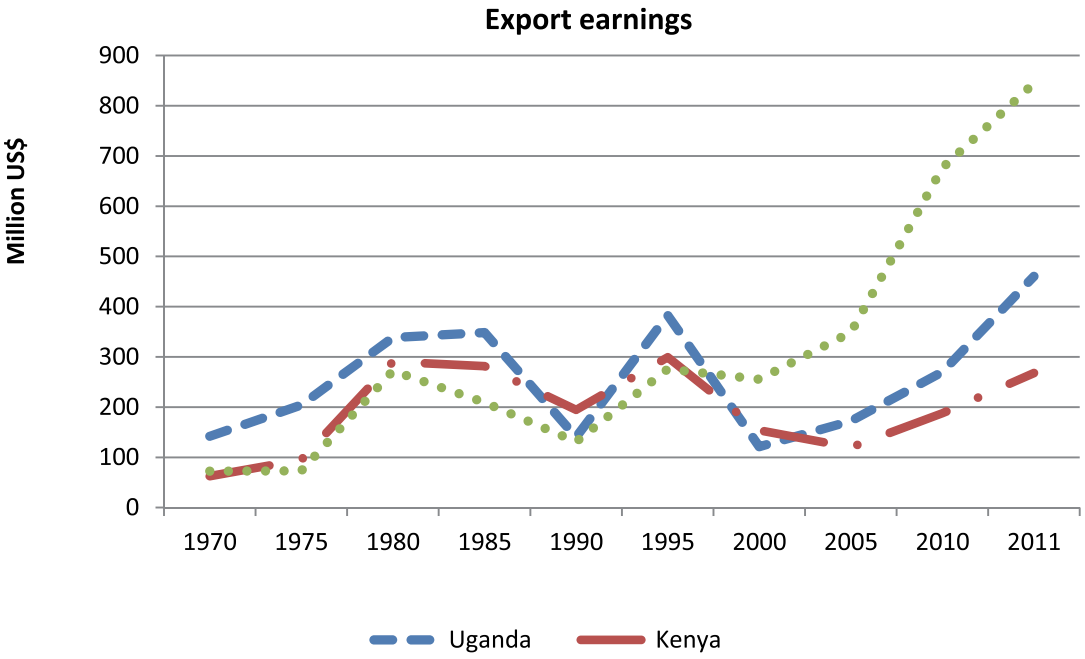


Data source: FAOSTAT (2014)

Figure 2B: Performance of the Coffee Industry in Uganda, Kenya, and Ethiopia



Data source: FAOSTAT (2014)



Data source: FAOSTAT (2014)

APPENDIX C: Coffee tree Estimates by district (mid-northern Uganda)

DISTRICT	COFFEE TREE POPULATION
Apac	**1,639,000**
Lira	**1,336,500**
Oyam	1,087,900
Dokolo	734,800
Gulu	**524,312**
Amuru	**408,405**
Amolatar	246,400
Pader	24,790
Kitgum	5,722

Source: UCDA (2010/2011). The highlighted districts were selected for FGDs and KIIs. Pader was replaced with Nwoya district, given more active coffee activities in Nwoya.

APPENDIX D: The propensity scores of treatment and control groups across blocks

Block	Coffee producers		Non-coffee producers		Mean diff. in P-score
	Obs.	Mean P-score	Obs.	Mean P-score	
Block 1	17	0.082	245	0.07	-0.0114563
Block 2	69	0.154	401	0.1465	-0.0074062
Block 3	173	0.296	402	0.284	-0.0117215
Block 4	117	0.493	121	0.478	-0.0146529
Block 5	60	0.677	32	0.680	0.0028201
Block 6	7	0.845	3	0.854	0.0091577

Source: Calculated from UNPS (2009/2010); Mean P-score not significantly different between the treated & control groups.

Appendix E: Descriptive Statistics For Selected Observable Characteristics

Variable	Coffee producers			Non-coffee producers			All		
	Obs.	Mean	S.D	Obs.	Mean	S.D	Obs.	Mean	S.D
Land ownership (%)	512	89	-	2414	67	-	2926	71	-
Land tenure (%): Freehold		59.49	-		42.10	-		46.38	-
Leasehold		0.68	-		1.10	-	2058	0.98	-
Mailo	496	9.32	-	1562	4.20	-		5.45	-
Customary		30.16	-		52.50	-		46.99	-
Other		0.36	-		0.10	-		0.2	-
Sex – male (%)	513	76	-	2415	71	-	2928	72	-
Age	513	49	0.934	2415	42	0.380	2928	43	0.326
Household size	513	7	0.301	2415	5	0.093	2928	6	0.093
Marital status (%): Married monogamously		56.96	-		51.19	-		52	-
Married polygamous		18.52	-		16.19	-		17	-
Divorced/separated	513	6.65	-	2409	12.35	-	2922	11	-
Widow/widower		16.11	-		13.3	-		14	-
Never married		1.75	-		6.97	-		6	-
Total		100	-		100	-		100	-
Education: Never attended formal school (%)	504	16	-	2240	18	-	2744	17.5	-
Attended/attending formal school (%)		84	-		82	-		82.5	-
Rooms occupied	513	4	0.0994	2415	3	0.063	2928	3	0.0572
Owns houses (%)	512	96	-	2404	70	-	2916	74	-
Owns TV (%)	512	6	-	2404	15	-	2916	14	-
Owns radio (%)	512	73	-	2404	63.5	-	2916	65	-
Owns bikes (%)	512	47	-	2404	36	-	2916	37	-
Owns cycle (%)	512	9	-	2404	6	-	2916	6.5	-
Owns vehicle (%)	512	1	-	2404	3	-	2916	3	-

Owns phone (%)	512	53	-	2404	54	-	2916	53	-
Owns other electronic equipment (%)	512	2	-	2404	4	-	2916	4	-
Owns other household assets (%)	512	55	-	2404	42	-	2916	44	-
Places lived for >=6 months at one time since 05/06	513	0.25	0.0186	2415	0.34	0.0155	2928	0.32	0.0141
Distance of main water source from dwelling - Kms	513	0.697	0.0514	2415	0.845	0.102	2928	0.821	0.0863
Amount of money paid for water per month	513	5768	183.288	2415	6861	211.529	2928	6682	185.352
Membership in LC committee (%)	502	16	-	2235	9	-	2737	10	-
Membership in SACCOs (%)	513	12	-	2414	6	-	2927	7	-
Credit access from a bank (%)	513	5	-	2412	5	-	2925	5	-
Health insurance for any household member (%)	513	1	-	2410	2	-	2923	2	-
Crop or any other agriculture insurance (%)	513	0.5	-	2410	0.015	-	2923	0.1	-
Region (%): Kampala	513	0.6	-	2415	11.24	-	2928	9.5	-
Central without Kampala		40.7	-		23.23	-		26	-
Eastern		22.55	-		21.34	-		22	-
Northern		3.15	-		21.22	-		18	-
Western		33	-		22.96	-		24.5	-
Total		100	-		100	-		100	-
Location – Urban (%)	513	8	-	2415	29	-	2928	25	-
Consumption expenditure	513	332991	21334	2415	296995	13650.4	2928	302894	12498.8
Fertilizer use on parcel (%)	465	16	-	1387	8	-	1852	10	-
Use of pesticides/herbicides on parcel/plot	463	5	-	1376	5	-	1839	5	-

Source: Author's calculations from UNPS (2009/2010) data.

Appendix F: Treatment effect using other PSM techniques

No. treated (Coffee producers)	No. controls (Non-coffee producers)	ATT	SE	t-statistics
Effect on total consumption expenditure				
(a) Nearest Neighbour Matching				
443	301	0.053	0.070	0.767
(b) Stratification technique				
443	1204	0.020	0.049	0.399
(c) Kernel matching technique (with bootstrapped standard error)				
443	1204	0.019	0.048	0.400
Effect on per adult equivalent consumption expenditure				
(a) Nearest Neighbour Matching				
443	301	0.046	0.059	0.774
(b) Stratification technique				
443	1204	0.029	0.043	0.687
(c) Kernel matching technique (with bootstrapped standard error)				
443	1204	0.027	0.040	0.666

Source: Calculated from UNPS (2009/2010) data

Appendix G

Below is the distribution of coffee nursery operators by district, as of January, 2014:

Table 1G: Nursery operators by district and type

District	# individual nursery operators	# community based nursery operators	Total
Lango sub-region			
Lira	13	7	20
Apac	4	2	6
Oyam	2	7	9
Kole	2	3	5
Dokolo	3	1	4
Aleptong	3	1	4
Amolatar	1	1	2
Otuke	0	0	0
Total: Lango sub-region	**28**	**22**	**50**
Acholi sub-region			
Gulu	30	12	42
Nwoya	8	10	18
Amuru	12	5	17
Pader	3	0	3
Lamwo	1	0	1
Agago	1	0	1
Total: Acholi sub-region	**55**	**27**	**82**
Grand total: Mid-north	**83**	**49**	**132**

Source: UCDA regional field office (mid-north)

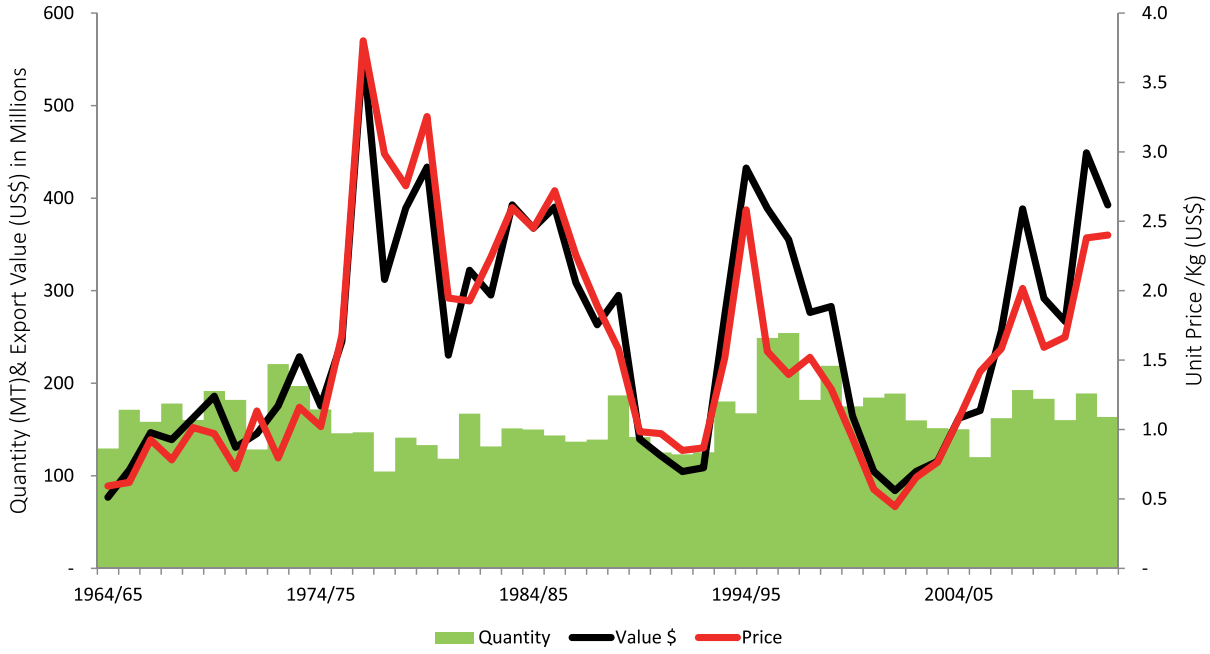
Appendix H

Table 1H: Actual coffee production in Acholi sub – region from 2007 to 2013 (kiboko in tons)

District	Coffee Type	Quantity in Tons (Kiboko) From 2007 - 2013						
		2007	2008	2009	2010	2011	2012	2013
Gulu	Robusta	2.9	4.5	6.8	8.7	9.2	10.4	12.5
Nwoya	Robusta	5.6	8.2	12.4	19.3	21.4	22.5	24.6
Amuru	Robusta	3.2	4.9	6	7.3	8.2	9	11.2
Pader	Robusta	0	0	0.7	1.4	2.1	2.8	3.8
Lamwo	Arabica	0	0	0	0	0	0	0
	Total	**11.7**	**17.6**	**25.9**	**36.7**	**40.9**	**44.7**	**52.1**

Appendix I

Figure 1I: Trends in Coffee Production, Export Value, and International Unit Prices (1964-2012)



Source: UCDA (2014)

Appendix J

Results of Conditional Quantile Treatment Effect (CQTE)

Quantile	CQTE
0.05	0.12** (0.0553)
0.10	0.09* (0.049)
0.11	0.102** (0.047)
0.14	0.092** (0.045)
0.15	0.070 (0.045)
0.20	0.052 (0.042)
0.25	0.041 (0.0397)
0.30	0.024 (0.039)
0.50	-0.007 (0.038)
0.60	-0.040 (0.039)
0.75	-0.048 (0.043)
0.80	-0.071 (0.046)
0.90	-0.059 (0.051)
Observations	1718

Source: Computed from UNPS data (2009/10). ***, **, * significance at 1%, 5% and 10% levels respectively; Standard errors are in parentheses. No significant effect of coffee production is observed in the upper quantiles. The outcome variable is natural logarithm of per capita consumption expenditure.