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Abstract

For most low developed economies in Sub-Sahara Africa (SSA), agriculture has been the main source of livelihood contributing 34% to Gross Domestic Product (GDP) and 64% to employment, either directly or indirectly. Dependence on agricultural commodities for exports has been accompanied by a high degree of price risk in terms of both volatile and declining prices, a phenomenon which has not only affected the way households allocate their resources but also affected their welfare in terms of consumption and poverty. In this thesis, three interrelated issues on market intermediation, diversification and poverty are studied at both household and community level in order to broaden our understanding on how risk affects household resource allocation decisions and subsequently, welfare. In the first part of the thesis, I study the impact of marketing strategies on household coffee incomes in a post-liberalised environment while the second part studies cover both the determinants of household diversification and link between poverty and diversification. Lastly I study the impact of diversification on the conduct of agricultural commodity markets.

Though placed in a wider context of development economics, the contribution to the state of the art is that the studies in this thesis combine aspects from agricultural economics, rural development and behavioural/experimental economics to generate results and policy recommendations on poverty policy from the broader point of view.

Keywords

Commodity Markets, Risk, Poverty, diversification, Agriculture

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COMMODITY MARKETS, RISK AND POVERTY

CHAPTER 1

1.0 INTRODUCTION

1.10 The Problem

For most low developed economies in Sub-Sahara Africa (SSA), agriculture has been the main source of livelihood both in terms contributing 34% to Gross Domestic Product (GDP) and 64% to employment, either directly or indirectly. Dependence on agricultural commodities for exports has been accompanied by a high degree of price risk in terms of both volatile and declining prices, a phenomenon which has not only affected the way households allocate their resources but also affected their welfare in terms of consumption and poverty. As a measure of mitigating the risk associated with volatile prices and weather risk in agriculture, most households have diversified their income portfolios, with diversification having varied welfare effects on the different classes of households.

1.11 The context

The subject of this thesis is "*Commodity Markets, Risk and Poverty*" and it is placed in a wider context of the development economics discipline which combines both aspects of agricultural economics and rural development. In the analysis, I use Uganda as a case study because it is commodity exporting low developed country which has successfully implemented Structural Adjustment Programs (SAPS), improved general welfare in terms of poverty and modestly diversified its economy over time. The core chapters of the thesis are based on the following broad areas;

a) Intermediation

Here, I study the impact of marketing strategies on seasonal cash crop (coffee) incomes under price risk.

b) Household diversification and Poverty

Here, I analyze the different dimensions of household diversification, including the share of non-agricultural income, the number of income sources and the scope of activity portfolios that households undertake. My aim is to determine the link between diversification and poverty in terms of the percentage of poor people in the community (poverty headcount), the depth of poverty and on the transitions into and out of poverty over time using panel data.

c) Diversification and Conduct in Agricultural Commodity Markets;

Here, I analyse community-level determinants to income diversification and impacts of this diversification on producer behaviour regarding production decisions and the balance between traditional cash crops, specifically coffee , and staple food crops, specifically maize, looking both across farm households and over time.

The three broad areas of the thesis are interconnected in that the major underlying factor affecting both crop marketing and income diversification behaviour is risk in terms of prices and weather uncertainties and the outcome variables resulting from such behaviour are concerned with welfare in terms of consumption, poverty, inequality and vulnerability.

1.12 Motivation for the Thesis

My motivation for this thesis is driven by the following questions.

(a) How has marketing behaviour in commodity markets changed after the implementation of market liberalization policies? Before the liberalization policies of the late 1980s, the prices of a number of developing country agricultural commodity exports prices were regulated by international agreements which were implemented through domestic regulatory agencies. The regulatory agencies' functions included centralized input supplies, extension services, farm credit backed by produce as collateral, quality control, transport and exporting of processed agricultural commodities to international markets. However, in part due to rent-seeking with the consequence that the main beneficiaries of controls were the government employees in the control organization, these regulatory agencies failed. (Gilbert 1997).

It is true that part of the liberalization policy objective was to increase the share of the world commodity prices received by farmers (Akiyama et al, 2001). This was achieved by reducing the monopoly of state marketing boards, caisses de stabilisation and parastatal intermediaries to allow entry by new players including exporters, bulking traders and itinerant traders. This will have increased competition in the marketing chain and should be expected to have reduced intermediation margins. However, in many cases, the increased share of price achieved by producers came at a cost of increased price risk most of which is borne by producers who previously had been shielded from such fluctuations by the previously dominant intermediaries. Another argument is that price increases, where they resulted after market liberalisation, were mainly driven by the reduction in taxes previously imposed on farmers by marketing boards other than increased competition through entry of new players into commodity markets (Gilbert, 2009).This increase in price risk has resulted into changes in behaviour in terms of commodity marketing strategies and resource

allocation with farmers reacting to price risk by diversifying and hence losing the potential benefits from specialization. A broad objective of this thesis is to find out what the missing links have been in the liberalization process so as to inform programmes that aim to improve the welfare of commodity producing households.

b) Coupled with price risk, rapid population growth in Sub Saharan African LDCs and climate change has led to increases both in the demand for food and in off-farm work opportunities. (IFPRI, 2008). The result is that income diversification has become the norm rather than the exception for commodity producing households. I inquire how this diversification has worked out in terms of the division of production between traditional cash crops and new staple food crops in producing communities. Do we see staple food crops substituting for traditional cash crops over time? Do we see major shifts in production? Which factors dominate in driving these observed diversification patterns at the community or village level over time? These questions are of importance for poverty policy because desperation-led diversification is likely to perpetuate poverty as household allocate their labour in low productive and low income activities for safety while, profit-led diversification may increase household income inequality since well-off households are more likely to access profitable non-farm activities. (Increasing inequality does not imply that the poor do not benefit).

c) My third motivation is derived from the fact that observed diversification patterns at community level may cloud activity patterns at household level. I take the diversification analysis to household level where I use a panel Ugandans households to analyse what dimensions of diversification are effective in reducing poverty over time. Here I study both the determinants of household diversification and the determinants of household poverty

over time. My aim is to determine whether income diversification has an impact on household poverty incidence, poverty depth and poverty transitions over time.

1.13 Structure of the Thesis

Following this brief introduction, I review the literature on commodity markets, risk, diversification and poverty in the second chapter. In the first part of the literature review, I set out the major theoretical models underlying the mechanisms in which agriculture acts as an engine for growth in the non-agricultural sector, the limitations to these models, the evolution of these models over time. Secondly I review the literature on commodity markets where I highlight the changes with respect to international marketing architecture, market power in global value chains and their impacts over time. I also explore the models that explain behaviour in commodity prices relative to broader price indices over time. Thirdly, I discuss the literature on income diversification and the non-farm sector at both national and household levels. Here I highlight the importance of backward and forward inter-sectoral linkages that create multiplier effects between the agricultural and the non-agricultural sector. I explore models that have been put forward to explain behaviour in the non-farm sector and how they have evolved over time. In the last part of the literature review section, I explore the theoretical aspects of risk, its measurement and the effects of risk on wealth and incomes. Here the methodological developments in measuring risk are highlighted and these combine experimental economics methods like lotteries, multiple price list methods undertaken by Holt and Laury (2002) and the famous studies by Binswanger (1980) on measuring risk and its effects on wealth and income which I subsequently use to elicit risk attitudes in chapter three among Ugandan coffee producers.

In chapter three, I study the impact of marketing strategies on seasonal cash crop incomes using a cross-sectional survey that I carried out within 700 coffee producing households in Uganda. Here I set out a model which shows the different marketing strategies in relation to farmers' discount (or impatience) rates. I analyze the determinants of the different marketing strategies and show the impact of these strategies on coffee unit values obtained by households at the end of the crop season. In chapter 4 I analyze the different dimensions of household diversification and their impacts on poverty over time. I extend the analysis to study factors determining entry, exit, switching and continuity of household enterprise over time and also analyze which activity portfolios produce greater gains in terms of poverty reduction over time. In chapter 5, I analyze community diversification in relation to conduct in commodity markets including; the determinants of diversification in communities, determinants of the proportion of farmers engaging in the production of traditional cash crops like coffee and how they have changed over time and effects on income inequality in communities.In chapter 6, I state the findings from my studies and how they relate to the broad literature and previous studies. I also draw conclusions and policy implications from the thesis and indicate new insights, uniqueness and the originality from my studies. I also draw policy implications and discuss limitations to my studies and issues for further research.

1.14 The Innovation of the thesis

Though placed in a wider context of development economics, the contribution to the state of the art is that the studies in this thesis combine aspects from agricultural economics, rural development and behavioural/experimental economics to generate results and policy recommendations on poverty policy from the broader point of view.

CHAPTER 2

LITERATURE REVIEW ON COMMODITY MARKETS, RISK AND POVERTY

2.0: Introduction

According to World Bank estimates, agriculture contributed one third of the growth in Sub-Saharan Africa and 81% of worldwide reduction in rural poverty between 1993 and 2005. Poverty is concentrated in rural areas with 3 out of 4 poor people living in rural areas and most of them depending directly or indirectly on agriculture for their livelihoods (World Development Report, 2008).

In order to deal with price volatility that is associated with high reliance on the agricultural commodity exports, less developed economies need to diversify into other sectors such as primary processing to add value, low technology manufactures and trade, and the skilled service industry. In these transitions, however, increased productivity in the agricultural food sector is key because it increases the competitiveness of the manufacturing and service sectors on international markets through reduced wages as food prices go down.

2.1.0 Agriculture as a driver of growth and Poverty reduction

2.11 The Lewis model

According to Lewis (1954, 1955), the movement of surplus labour from low-productive agriculture to high-productive non-agricultural sectors is the main driver of growth. Lewis theorized that, in poor countries where the population is so large relative to capital and natural resources, the marginal product of labour in the agricultural sector is close to zero such that reductions in the surplus labour in agriculture come at little or no cost to

agricultural productivity. Lewis's view is not consistent with labour being paid its marginal product of zero or close to zero but rather its average product, $\overline{w}$. This may happen in family enterprises where the family shares total output and family members have an obligation to work for the family enterprise. Lewis' surplus labour theory also implicitly assumes poorly functioning labour markets which is a plausible assumption for most poor countries in Sub-Saharan Africa where off–farm work opportunities are scarce. If off-farm work were available, it would be better for the family to limit or cut down on farm labour and send some family members to work off- farm.

In addition, the surplus labour theory assumption that the marginal product of farm labour be zero is extreme and unnecessary. It is sufficient that the marginal product of labour in industry exceeds that in agriculture, creating a dividend from the re-allocation of labour, and that the average product in agriculture exceeds the marginal product in industry, so that there is no incentive for individuals to move from industry to agriculture. What is required for countries to grow through the transfer of agricultural labour is a situation of disguised unemployment where the marginal product in agriculture is lower than that in alternative of farm occupations (Deaton and Laroque, 2003).

Important evidence in relation to the Lewis model derives from a natural experiment in which a 1918-19 epidemic resulted in a large number of deaths in India. Schultz (1964) found that agricultural labour fell by 8.3% whereas the area sown fell by 3.8%. If Lewis'surplus labour theory were valid, the reduction in the agricultural labour force due to the epidemic should have had no effect on output and on the land under cultivation. This questions the validity of Lewis's theory. However, according to Sen (1964), Shultz's (1964) argument is not conclusive in explaining the failure of the surplus labour theory because of

the uneven impact of the epidemic which resulted in non-marginal reductions in the labour input for some households or villages where the death toll was highest but with little impact on other households or villages.

2.12 The Ranis-Fei Model of Agricultural surplus labor- driven growth

Ranis and Fei (1961) formalized the growth process in a model that views growth as resulting from the transfer of labour from agriculture to industry with capital accumulation rising from the surplus between agricultural production and the average wage bill.

Suppose workers are paid the average product of agricultural labour $w_a = ap_a > mp_a$ on the farm and the marginal product in industry $w_i = mp_i$ off-farm. Workers will move into industry as long as $w_i > w_a$ and thus the average product in agriculture will set the floor to the industrial wage. The difference $mp_i - mp_a$ is the marginal agricultural surplus which is the gain to the economy from shifting labour out of agriculture. Investment of this surplus capital generates the demand for industrial labour.

Although the Lewis-Ranis-Fei model sees industrial capital as generated by agricultural savings, one has to be clear on how these agricultural savings arise in practice. First, these savings could be voluntary as agricultural households save and invest in industrial capital such as textiles, as in the Asian economies. The second is the socialist alternative in which government taxes agriculture and invests in industry. This was the dominant approach underlying import substitution policies in the 1960s and 1970s in LDCs. The Ranis-Fei model foresees rising levels of agricultural taxation as labour is withdrawn from farms thereby increasing agricultural productivity. Although African agriculture was heavily taxed to finance industrial growth in the 1970s and early 1980s, agricultural productivity growth was

slow. Possible explanations include price volatility in agricultural commodity markets, low levels of infrastructure investment, and poorly functioning credit institutions. A third way of generating savings has been over-valuation of the exchange rate which is maintained by import tariffs or quotas on industrial goods. Over-valuation depresses the price of exportable food increasing real wages in industry and reducing the value of agricultural production.

The pace of economic transformation in Sub-Saharan Africa has been relatively slow with the majority of households engaged in agricultural production and limited agricultural processing. Trade in agricultural and general merchandise is mainly restricted to urban and semi-urban households while the manufacturing sector has been dominated by low-technology and low value-added products (UNCTAD, 2009). The limited success of agricultural surplus labour in improving economic growth has been partly due to internal polices like taxation of agriculture and exchange rate over-valuation. Prior to market liberalisation, urban-oriented policies in LDCs taxed farmers in order to keep food prices artificially low for the urban electorate. In addition centralised marketing bodies for agricultural exports were used to tax agricultural commodities in order to get revenues for governments all of which led to artificially low agricultural prices and thus low or no surplus incomes from agriculture. Exchange rate over-valuation increases the prices of imports relative to agricultural exports , thus raising consumption expenditure and leaving little or no surplus income from agriculture into other sectors. These policies have tended to increase rural poverty and made the agriculture sector uncompetitive, in many cases without significant investment in industry. Another factor that affects the transfer of savings

from agriculture to industry is price risk in international agricultural commodity markets, a subject of discussion of the next section.

2.20 Price Risk in Agricultural Commodity Markets

2.21 Price trends and Volatility in Commodity Markets

Price risk in agricultural commodity markets arises both from price volatility and from the declining trend in the price of agricultural commodity prices relative to manufactured goods over time. (See Figures I, 2 and 3 on pages 50 and 52 for Uganda's case). Since many least developed countries in Sub-Saharan Africa depend on exports of few commodities as a major part of their export earnings, they are challenged by sharp fluctuations and long-run trend movements in commodity prices. Price risk largely impacts on real output, the balance of payments and government budgetary positions, which consequently, result into difficulties in the conduct of macroeconomic policy. Commodity price volatility is mainly due to the low short term price elasticities of demand for agricultural commodities in world markets. Since commodity supply and demand forces respond inflexibly to price fluctuations, one side of the supply/demand equation is always trying to hit a moving target. Agricultural production can be the most difficult to adjust, since planting and planning decisions must be made far in advance of physical purchases. Thus, situations of oversupply can last a long time while it can be difficult to boost production in the case of a shortage (IISD, 2008).[1]

Prebisch (1950, 1962) and Singer (1952) noticed that the terms of trade of commodities appeared to deteriorate over time, and argued that the prices of commodity exports would

[1] The prices of tropical export crops are currently high and it is possible that the declining trend is now over

continue to fall relative to manufactured imports. The Prebisch-Singer hypothesis states that due to the low income elasticity of demand for commodities and higher total factor productivity for primary commodities relative to manufactured goods, the price of commodities relative to manufactured goods should decrease over time. If true, this hypothesis would imply that the long term outlook for agricultural commodity exporting countries would be unfavorable. Although Prebisch (1950) and Singer (1950) originally found a downward trend in real commodity prices, Lipsey (1994) found that once allowance was made for the annual 0.5% improvement in the quality of manufactures, the case for long term deterioration in relative commodity price becomes weak.

Although later work by Grilli and Yang (1988), using data from 1900–88, found that the downward trend in commodity prices accelerated in 1921, other authors did not detect this adverse trend movement. The debate on the Prebisch-Singer hypothesis is whether the non-stationarity of real commodity prices takes the form of a deterministic trend or a stochastic trend, or whether there are structural breaks in the trend. Cashin and McDermott (2002) find that the existence a downward trend in real commodity prices is of little practical policy relevance because it is small and completely dominated by the variability in prices.

Turning to the adverse price trend, Singer (1950) argued that serial price declines are due to the fact that primary commodities exhibit lower income elasticities of demand than manufactures which would imply that relative prices would decline over time. However, this argument is may not be sound on grounds that the long term impact of low elasticities would be lower commodity production, and not lower prices. Although Lewis (1954) saw the prices of tropical agricultural commodities as being determined by subsistence costs ,

this only holds true to the extent that labour remains in surplus and if there is no productivity growth (Deaton and Laroque, 2003)

The wedge between the farm-gate prices of raw or semi-processed commodities (like coffee and cocoa) and the prices of processed commodities in international markets in global value chains is due to the differential effects of technical advance in primary and manufactured goods. In manufactured goods, technical change results in quality improvements that are in part matched by price increases, while in agriculture, productivity advances will be reflected solely in lower prices of commodities. Lipsey (1994) argued that the apparent decline in primary prices relative to those of manufactures is because manufactures prices do not fully take quality improvements into account. When he adjusts manufactures prices for quality change the trend disappears.

2.22 The behaviour of commodity market prices and Storage

Deaton et al (1992) summarize some stylized facts about the behaviour of 13 commodities over the period 1900 to 1987. They show that commodity prices are highly auto-correlated, highly volatile and show skewness and kurtosis. They find positive skewness for most of the commodities with most commodities having no or very few downward price spikes to match the pronounced upward spikes. They also find that despite the substantial volatility in the prices of these commodities, the low persistence measures of less than 0.3 for all the commodities show that commodity prices tend to revert to their mean or to a deterministic trend over time. For practical purposes, commodity price time series have been hypothesized to follow random walks. (Cuddington et al, 1988). However, the observed persistence measures (Deaton 1992) for most of the commodities are much lower than the figure of unity implied by the random walk model. In addition, the random walk hypothesis

requires that all fluctuations in price be permanent, a feature that makes this hypothesis implausible for commodities where weather plays a major role in the price fluctuations (Deaton and Laroque, 1992) .

2.23 Storage as a means to mitigate price fluctuations (shocks)

Storage offsets the effects of adverse shocks but only does so with positive shocks to the extent that material is already in storage and hence can be destocked. According to Deaton and Laroque (1992), commodity speculators can smooth commodity prices by buying cheap and selling expensively. In addition, the activities of speculators induce autocorrelation in prices even when none would exist under a simple supply and demand process with temporally independent shocks. The implications are that price becomes a nonlinear function of availability and cycles are characterized by flat bottoms but sharp peaks. In addition, prices are positively auto-correlated even if harvests are independent (Gilbert, 2006). Price variability has often been explained by supply factors while auto-correlation has been explained by activities of speculators. However, Deaton and Laroque (I996) show that although speculation can increase autocorrelation, it does not do so to the extent observed in the data.

2.24 Causes of the 2006-2008 booms in agricultural commodity prices.

Between 2005 and 2008, the prices of food commodities more than doubled and this price increases were general across a range of agricultural products with a few exceptions like sugar. There has been a controversial debate over the causes of the recent price movements with some people wondering whether these price movements signal a reversal of the downward trend. One school of thought to the causes of these food price increases

was the poor grain harvest in Europe coupled with drought in Australia, thus resulting in poor wheat harvests in 2006 and 2007 and low stocks in 2008 (Mitchell, 2008). Another explanation was the use of food crops as bio-fuels leading to reduced allocation of arable land to food production.

Gilbert (2010) argues that macroeconomic and monetary factors, not supply side factors, are the major drivers of large movements in agricultural prices. According to Gilbert (2010), the explanation behind the recent boom is a general one, relating to inter-linked markets as opposed to explanations relating to particular markets. He shows that common shocks, which are mainly macroeconomic demand side shocks in agricultural markets, dominate movements in agricultural price indices and are likely to be more important than idiosyncratic supply shocks at aggregate level. Common demand shocks generate larger price responses than idiosyncratic demand shocks, implying that common (i.e. macroeconomic and monetary) demand-side factors should be seen as the main candidates for explaining major changes in agricultural food prices in the aggregate. See also Radetzki (2006), Abbott *et al* (2008), Headely and Fan (2008) and IFPRI (2008).

2.25 Governance in global value chains

Another important issue in commodity markets is governance in global value chains. According to OXFAM (2002), one of the major problems in commodity markets has been the increase in market power by multinational processors in global value chains (like coffee and cocoa), which seem to come at the expense of agricultural producers in LDCs. Gilbert (2006) analyses prices and costs in coffee and cocoa global value chains, and finds that long term trends in commodity prices and the concentration of market power in global value chains like coffee and cocoa depends on changes in production and marketing costs over

time. Daviron and Ponte (2005) explain a coffee paradox which is characterized by the co-existence of a coffee boom in consuming countries and of a coffee crisis in producing countries. They observed that while coffee bar chains had expanded rapidly in consuming countries, international coffee prices had fallen dramatically and producers received the lowest prices in decades. Their explanation for this paradox is that what farmers sell and what consumers buy were increasingly becoming are different coffees in that it was no longer is not material quality that contemporary coffee consumers paid for but rather ,the symbolic quality and in-person services. In order to tackle low prices, coffee farmers and their organizations need to control some parts of this immaterial production , an unlikely proposition for LDCs in Africa(Daviron and Ponte 2005).This argument is in line with Gilbert's explanation of changing production and marketing costs driving governance in global value chains rather than increasing market power by multinationals (OXFAM, 2002).

2.26 Production and consumption shocks in LDCs

Production and consumption shocks in developing countries may be covariate or idiosyncratic. Idiosyncratic shocks affect individuals or households and these can be mitigated completely through savings and other consumption smoothing mechanisms. Examples include the death of family member, sickness and others. Covariate shocks are those which affect entire villages or communities and these are more difficult to mitigate since everyone is affected in the same way. Examples include weather shocks leading to crop failures. Others include price shocks. Compared to other shocks, production (weather) shocks are likely to be more important in developing country developing country commodity markets.

2.3 Commodity markets and liberalization policies

Prior to the liberalization policies of the late 1980s and 1990s, the prices of a number of developing country commodity agricultural exports prices were regulated by international agreements. This was true of coffee, cocoa, sugar and natural rubber. These agreements operated through a mixture of quota-based export controls and buffer stock storage - see Gilbert (1987). Gilbert (1996) concluded that the International Coffee Agreement, which ceased to intervene in 1989, was the only successful agricultural commodity agreement. These international arrangements were complemented, and also implemented through, domestic regulatory agencies – typically marketing boards in the Anglophone countries and caisses de stabilisation in the francophone countries. Marketing boards also existed for some commodities not subject to international controls. In other commodities, such as cotton in francophone countries, domestic controls were exercised through parastatal monopoly-monopsony processing companies. Knudson and Nash (1990) review this experience.

The functions that these institutions undertook included centralized input supplies, extension services, farm credit backed by produce as collateral, quality control, transport and exporting processed of agricultural commodities to international markets. They also served as avenues for producing governments to tax agricultural exports in order to finance government expenditure, an action which turned out to be a disincentive to producers who obtained very low prices from the sale of their commodities (Knudsen and Nash 1990).As a result of rent-seeking behaviour within marketing boards, the main beneficiaries of controls were the government employees in the control organization (Gilbert ,1997). In addition the commodity agreements were abandoned. At about the same time, the World Bank and the

European Union begun to push for Structural Adjustment Policies (SAPs). The main aim of these structural adjustment policies was to liberalize agricultural commodity supply chains with a view of reducing inefficiencies and increasing competition (Bohman et al, 1996). Marketing boards and caisses were disbanded or saw their powers reduced and parastatal intermediaries lost their monopoly positions (Gilbert ,1996). An important liberalization objective was to allow farmers to receive a larger share of the export price and this has indeed resulted. However market liberalization has also increased the extent to which fluctuations in the world prices are passed from exporters to producers – a so-called "second generation" problem (Akiyama and Varangis, 1995). Greater price fluctuations at all levels of the marketing chain suggest an increase in price risk faced by market participants, with producers bearing most of it (Hill 2006).

An example is Ugandan coffee. Uganda is a major producer of robusta coffee which, over the past two decades, has experienced a combination of price volatility and persistently low prices in international commodity markets. Part of the problem was the failure to renew coffee quota export controls of the International Coffee Organization in 1989. These were followed by major production increases in Brazil and Vietnam. The increase in Brazil was probably stimulated by the ending of ICO controls since Brazil had been squeezed by higher cost producers over the operation of the coffee agreement and had steadily lost market share. Since Vietnam was not a member of the agreement, it would not have been subject to ICO quota controls. In order for the ICAs to accommodate Vietnam, other producers would have been obliged to cede quota which was highly unlikely. Therefore the ICA would not have survived Vietnam's arrival on the coffee market. Ugandan coffee is low quality whilst most growth in the coffee industry in recent years has been through an increase in consumption of high quality coffees at the expense of low quality coffees. This increasing product differentiation in

the consumption market means that Vietnam's entry into robusta production was more of a concern to robusta prices in Uganda than Brazil's growth in coffee production.

These production increases should be seen in the context of slow consumption growth in traditional coffee-consuming countries, in particular the United States, leading, to extended periods of low prices in world markets (Gilbert 2005). Coffee is a ‘’mature’’ product with a less than unit income elasticity in its traditional markets. Given that coffee consumption grows at a fraction of the countries’ growth rates, aggregate growth depends on penetration of new markets. An example is Brazil which is currently the second largest coffee consumer in the world. Here, growth in Brazilian consumption has been an important contributor to aggregate growth. With little penetration of coffee into the Chinese markets, other major growth markets are have been “tea- culture” countries especially the UK and Japan. According to Fafchamps (2005), the other part of the problem lies within the market structures and institutions arising after liberalization, especially with private traders entering agricultural markets. These structures and institutions were not adequately scrutinized at the time of liberalization, possibly leading to loss of productivity and competitiveness in the coffee sector. Liberalization not only spurred market entry but also reduced the number of producer cooperatives, thus disorganizing input distribution and subsequently, stagnating coffee exports.

Prior to liberalization, producer cooperatives not only marketed coffee but also advanced production and production credit to coffee producers. The reduction in the number of cooperatives, together with the reduced resources of those that survive, has left many poor farmers without access to credit. Thus, faced with increased price volatility, poor

households with no collateral are unable to borrow against future income (Beck and Demirgùç-Kunt 2008). Micro credit is poorly developed in rural Uganda, as elsewhere in Africa, perhaps because, even when they are credit-worthy, poor households seek loans that are too small to be profitable at common interest rates – Johnston and Morduch (2008) in relation to Indonesia.

However some commentators have questioned the effectiveness of the credit function when cooperatives were active. One school of thought would be that since they were not as many micro-finance institutions in rural areas then, cooperatives might to some extent have been effective since they partly saved some of the proceeds from the coffee sales. A counter argument to this is that cooperatives could only supply credit to farmers if they were financed by banks because banks could have found this attractive since the cooperatives could enforce repayment. However, if the cooperatives themselves had a poor financial base, it became too risky for the banks to intermediate through them. It could therefore be the case that during the time they were active, cooperatives were only able to provide the credit function so long as governments were prepared to pay off any deficits the cooperatives might develop with the banking system, or to write off bank debts to the government itself. This argument may then put a caveat to the credit function provided by cooperatives during their active times.

The combination of increased post-liberalization price volatility, relatively low real coffee prices and the pervasive lack of credit has generated changes in the way coffee-producing households market their coffee in Uganda

2.4 Coping with Price Risk: Diversification

As part of the efforts to cope with seasonality, price volatility and serial declines in commodity markets, farming households have chosen to diversify their income sources into non-farm income sources. Households not only diversify their incomes but also assets and activities. At the household level, income diversification both on and off-farm is now the norm rather than the exception for most producers of traditional agricultural export commodities. Given that the peaks and troughs in demand for agricultural labour leave many rural people seasonally unemployed, secondary non-farm employment can be useful in raising and smoothing income over the year, even when this is a low productivity employment. In addition to smoothing the flow of income received by agricultural households over the cropping season, non-farm income may stabilise total income by spreading risk through diversification. Given the standard assumption that utility functions are concave in consumption, a smoother flow of income directly increases welfare at a constant level of expected income (Lanjouw et al, 2001). That's said there must be a distinction between income diversification in the face of price declines which is optimal, and income diversification to cope with risk which may not be optimal if there are more efficient insurance mechanisms .

Morduch (1993) studied 10 Indian villages in the semi-arid tropics (ICRISTAT) over the period 1976 to 1984. He found that those households which were more constrained in terms of their ability to obtain consumption credit when faced with a bad harvest were more likely to minimise the risk of a bad harvest in the first place by scattering their plots more widely and choosing a more diversified cropping pattern. This underlines the fact that households are

concerned about risk when making production and diversification decisions. Diversification out of agriculture may actually result in increased agricultural earnings. First, it is possible that, by earning non-farm income, farm households can also obtain to higher average agricultural incomes in that they are now more willing to choose high risk/high return options. Secondly, additional income from outside farming enables farmers to purchase costly inputs required to participate in high return options especially in the absence of low cost credit as is the case in many LDCs in Sub-Saharan Africa. This partly explains why larger and wealthier farmers are often observed to be the first adopters of new agricultural technologies. Analysing data on smallholder agriculture in Kenya, Collier and Lal (1986) found that crop output was significantly related to non-crop income and liquid assets after controlling for production inputs. This finding suggests that wealthier and more diversified farmers were making higher productivity cropping choices. They also found that non-farm income not only increased household finances for purchasing inputs but was also important in obtaining credit.

Economic theory views income diversification in the context of risk-aversion such that poor farming households engage in many low-return but low risk activities to mitigate weather and price risk. However, income diversification need not be confined to poor households. In a study on a Kenyan town of Kutus, Evans and Ngau (1991) found that farm revenue is positively associated with the proportion of land devoted to coffee relative to maize after controlling for input costs. In addition they found that the proportion of land given to coffee is positively associated with non-farm revenue, suggesting that even the wealthiest farm families still diversify risk by continuing to grow maize. Non-farm diversification as a risk-mitigating measure may be limited to cases where the non-farm sector depends on derived

demand from local agricultural incomes, as in the Ranis and Fei (1961) agricultural surplus growth models. In such cases, farm and non-farm incomes will covary and so diversification will only effectively smooth idiosyncratic risk. An example was the severe drought in the North district of Tamil Nandu which led to an over 50% fall in normal rice yields. For non-agricultural households, average income reduced from 493 rupees in 1974 to 19 rupees in 1983 and a subsequent rebound to 1094 rupees the following years which was a clear case of non-farm income being very sensitive to levels of agricultural income (Hazel et al.,1991a). In other cases, total income is relatively more stable than cropping income. This was the case of the three regions studied by Reardon et al (1992) in Burkina Faso where they obtained ratios of the coefficient of variation to the coefficient of variation of cropping income of 0.61, 0.76 and 0.69. Lanjouw and Stern (1998) show that the expansion of non-agricultural employment opportunities accompanied a fall in which household incomes in the village co-vary in the north Indain village of Palanpar. Therefore, non-agricultural incomes will possibly be an income stabilising factor in most cases.

The factors underlying income diversification at household level include “push” factors such as reduced marginal returns to labour as family labour working on fixed agricultural plots of land increases, insurance against risk and shocks, but also “pull” factors like changes in rural infrastructure with respect to markets, health, education, roads and access to electricity ,all of which provide new opportunities to diversify away from agriculture at community level (Barret et al, 2001).

At the national level, governments in Sub-Saharan Africa have been advised to broaden the portfolio of crops and activities so as to reduce on the effect of price volatility that arises from the export revenue dependence on a few agricultural commodities. Progress in new

regional markets in Sub-Saharan Africa have presented new opportunities for staple food crops, such as maize, which until recently were not traded in an important way across national borders, to become competitive relative to traditional cash crops like coffee and cotton over time as sources of farm revenue. In addition, there have been new opportunities for high value exports in horticulture including cut flowers, fruit and vegetables.

Economic theory distinguishes between open and closed economies. In practice, although many Sub-Saharan African economies are open from a legal standpoint, the combination of poor infrastructure, large distances and low volumes of production make the costs of international commerce prohibitively high for many agricultural products. We can refer to such economies as semi-open in relation to the commodities in question.

Semi-open economies usually render traditional food staples and coarse grains like maize non-tradable such that domestic increases in the demand of staple foods cannot be met by imports of staple foods or imports of close price substitutes of the staples. Instead, the increased staple food demand is met by rising domestic relative prices to choke-off demand and stimulate an increase in production depending on the elasticity of supply of the staples. Given that the of staples is usually inelastic with respect to price, they are demand-constrained implying that net increases in rural demand for staples might not result in increased agricultural incomes through sustained increased production and higher prices. (Delgado, 1995)

2.5 Diversification in relation to Inequality and Poverty Alleviation

In developed economies where asset markets are well developed, households can easily exchange assets when their asset ratios do not maximise profits. Due to lack of well developed asset markets where assets can be exchanged when asset ratios do not maximize profits, individuals in LDCs allocate assets across activities in order to equalize marginal returns in face of complementarities between assets like land . This results into desperation-led diversification for the poor households leading to highly diversified portfolios with low marginal returns (Barrett, 1997; Reardon et al, 2000: Little et al, 2001).

There is a growing importance of non-farm income (about 40-45%) despite the "subsistence farmers" picture usually painted about Africa (Bryceson & Jamal, 1997; Reardon 1997; Little et al , 2001). This in reflected in the positive correlation between non-farm activity and income and or wealth (in form of land or livestock) in rural Africa, seemingly offering a pathway out of poverty on one hand but also drawing a wedge between well-off households that can access profitable non-farm activities and poor ones that get trapped in low entry barrier, low income activities. Although proliferation of non-farm jobs may widen the distribution of income, this does not necessarily mean that the poor do not benefit at all (Lanjouw et al, 2001). This because households faced with seasonal unemployment and those that are unable to participate in the agricultural labour market may derive economic security from low non-farm wages. Thus, despite some employment activities in the non-farm sector providing workers with low returns relative to those obtained from casual agriculture labour, such employment may be welfare-improving because it may serve to reduce income inequality at the aggregate or national level (Lanjouw et al, 2001).

Due to the global recession, agricultural commodity prices in world markets and aid flows to compensate terms of trade losses at macroeconomic level declined in Sub-Saharan Africa

over 2009 although many of these prices have risen sharply through 2010. In analyzing macroeconomic impacts of commodity price shocks Collier (2005), claimed that poverty implications of large and contagious negative price shocks in exports of agricultural commodities depend upon both the scale and the incidence of the shocks. This is because the impacts of large commodity price shocks are multiplied beyond the direct decline in export income to reduced demand for producers of non-tradable goods and services. According to Collier, the incidence of adverse price shocks have greater effects on low income households involved in flexible activities like self employment further pushing them into poverty by comparison with workers employed in less flexible formal employment. Thus, diversification into previously non-tradable staples (like maize, and cereals) for export to emerging regional markets may reduce the effects of commodity price shocks for rural farm households while reducing secondary impacts in the non-tradable sector as well.

According Barrett et al (2001), poverty policy generally aims to improve the asset holdings of the poor by:

i) endowing them with additional financial (credit), fixed (land) , human (education & health) or social assets

ii) increasing the productivity of the assets they hold e.g improved seeds on land productivity , training for labour productivity etc

iii) or both of these.

Diversification patterns across incomes, activities or assets reveal how households trade-off expected returns and exposure to risk during the allocation of their resources, given the resource constraints. Thus, understanding incomes diversification patterns among

household over time is useful in identifying effective ways of reducing vulnerability poverty plus targeting transfers to the poor. This is the subject of chapter four of the thesis.

2.6 Policy implications of sectoral linkages between agricultural commodity markets and non-tradable sectors;

Due to the semi-open nature of many SSA economies, Delgado (1995) suggests adoption of pro-active diversification policy support to promote rural growth, increase employment and adjust relative prices. This would involve three commodity specific policies; promotion of traditional agricultural exports by ensuring low and stable food prices trade-creation policies between low and high potential agricultural zones and promotion of non-traditional exports. These policies will enhance the complementary and mutual dependence between the development of the traditional tradable cash crops and staple food crops. This is due to the fact that increasing value added in export agricultural activity is not possible without ensuring food security in rural areas that devote a high share of resources to subsistence food production. According to Delgado (1995), low and stable food prices are essential for growth, welfare, and food security in dynamic non-food cash crop areas, since they are the basis of rural competitiveness in non-food production. Low and stable food prices help ensure that the returns to production of items that rural areas have a comparative advantage in are not eaten up by the subsistence costs

Delgado suggest different policies with respect to high and low food zones. In high potential food zones, incomes policy should be productivity led rather than price led while growth policy in low potential area will involve diversification into things other than staple foods. Thus policy needs to promote better marketing links in both directions between higher and lower potential areas. Such policies involved pro-active commodity planning or zoning such

that specialization in one zone is accompanied by diversification in a neighbouring zone, with enhanced supply response on non-tradables is low potential zones such that national diversification is compatible with regional (zonal) specialization with the country (Delgado, 1995). This issue is further stressed in the UNCTAD report on the State and Development of Governance in LDCs which states that "Well prepared public investments including a careful assessment of likely linkage or multiplier effects, will crowd in private initiative and investment''. (UNCTAD, 2009)

In approaching the problems of agricultural underdevelopment, it is important to frame the issues in a broader context of developing the rural economy and not just in terms of farmers and crop or livestock production. The rural non-farm economy comprises of all non-agricultural activities which generate income to rural households including in-kind income and remittances and in some contexts, mining and timber processing. The broader context of the rural non farm economy would focus on developing clusters of inter-related activities, including various services to support the community. Moreover, the presence of a rural economy in a given area does not mean that it is either possible or desirable to promote a flourishing rural non-farm economy, either through work for wages of self employment. For some areas, the only future might be the long term decline of farming, accompanied by substantial outward population migration. Therefore before setting up programmes to support the rural non farm economy and inter-sectoral linkages, LDCs should take a serious look at agriculture in a given area, examine its economics and consider what income levels it can reasonably support. (UNCTAD, 2009)

2.7 A model of rural non-farm activity behaviour

Hymer and Resnick (1969) formulated a model to explain the decline of rural non-farm activities under colonialism. They envisaged an initially self sufficient economy producing both agricultural goods and other goods and services labeled Z-goods, for local consumption. On the one hand, colonialism provided new opportunities for exporting cash crops and natural resources, while on the other hand, it made available cheap and higher quality manufactured goods from the outside world. The effects were that both the competition from imports and the drawing off of labour into the cash crop sector would stifle rural non-farm activity. Ranis et al (1993) extended Hymer's model by positing a two part Z-good sector. Part of the Z-goods sector was used in producing low- productive traditional goods and services in households and villages while the other was composed of modern activities which are often located in towns. The "new economic geography" location models allow for the two-way flow of goods , i.e. not only from urban to rural areas but also from rural producers to urban consumers.

2.71 Inter-sectoral linkages

Due to the emergence of green revolution technologies, Mellor (1975) saw a virtuous cycle emerging such that increases in agricultural productivity and subsequently incomes of farmers, would be magnified by multiple linkages with the rural non-farm sector. They entailed production linkages both backward (via the demand from farmers for inputs such as ploughs, pesticides, tools etc) and forward linkages arising from the need to process the many primary agricultural goods. In addition consumption linkages were also important since rises in agricultural income would translate into an increased demand for goods and services produced in nearby villages and towns. There were further potential linkages through the supply of labour and capital as increased productivity in agriculture released labour or raised wages resulting into a new agricultural surplus that would be a source of

investment funds for the non-farm sector. To complete the cycle, growth in the non-farm sector was expected to stimulate still further growth in agricultural productivity via lower input costs (backward linkages), profits invested back into agriculture, and technological change. Thus growth in the two sectors would be mutually reinforcing with employment and incomes increasing in a dispersed pattern (Lanjouw et al, 2001). This is the line of inquiry favoured for cost benefit analysis for agricultural investments capturing the full set of regional impacts

2.80 Risk aversion: Measurement and Income/Wealth effects

Economists model risk aversion using the Expected Utility Theory (EUT) developed by Von Neumann and Morgenstern (1947), where risk aversion is modelled as arising solely because the utility function over wealth is concave. EUT which assumes compliance with the ordering axioms of continuity and independence of the decision maker's preferences has been the basis for much of the decision making theory. Coupled with axioms of continuity and independence over the decision maker's preferences, EUT postulates that there is a utility function *U*, that assigns a numerical value to each of the alternatives under choice. In so doing, EUT allows the ranking of alternatives within the risk context (Mas Collel et al, 1995).

Despite its elegance and widespread use in modelling risk in economics, the diminishing-marginal-utility of wealth theory been widely criticized. There is a major debate among economists about the validity of this theory on the grounds that, much as the theory is good at predicting risk aversion in relation to large stakes, it miserably fails with small stakes (Arrow, 1971). Arrow's hypothesis was decreasing absolute risk aversion plus increasing relative risk aversion. Criticism of the Expected Utility Theory (EUT) is based on the work of

Arrow (1971) who showed that an expected utility maximizer with a differentiable utility function will always want to take a sufficiently small stake in any positive expected value bet. In other words, expected utility maximizers are (almost everywhere) arbitrarily close to risk neutral when stakes are arbitrarily small Binswanger (1981) disproved Arrow's prediction of declining absolute risk aversion the after his classical experimental work and article of 1980 on measuring risk attitudes of rural farmers in India and showed that relative risk aversion was not rising but instead declining. Binswanger went on to show that Arrow's assumption of monotonic behaviour of relative risk aversion, which implied that relative risk aversion must rise over the entire interval was undermined by his experimental results which showed that many individuals declined small positive net value gambles. This contradicts the claim that absolute risk aversion should be zero for very small gambles. These experimental findings nullify the criticism that the widely used diminishing-utility–of -wealth model of risk predicts poorly with modest stakes.

According to the critics (Kahneman and Tvesky, 1979), the problems with assuming that risk attitudes over modest and large stakes derived from the same utility of wealth function relate to a long standing debate in economics pertaining to the powerful prediction which EUT makes about amalgamation of independent gambles. i.e. that economic actors do not see an amalgamation of independent gambles as significant insurance against the risk of those gambles. To that extent, they claim that using expected utility theory to make inferences about the risk attitudes towards the amalgamated bet from the reaction to the one bet or vice versa would be misleading. They go on to suggest alternative models to EUT more specifically prospect theory which is based on loss aversion which they claim is the most firmly established feature of risk preferences empirically.

Prospect theory describes the decision processes where agents have to make choices between alternatives that involve risk as consisting of two stages i.e. editing and evaluation. In the first stage, possible outcomes of the decision are ordered following some heuristic. People decide which outcomes they see as identical and set a reference point from which they consider lower outcomes as losses and larger as gains. In the evaluation phase, people behave as if they would compute a value (utility), based on the potential outcomes and their respective probabilities, and then choose the alternative having a higher utility (Kahneman and Tvesky, 1979).

In 1981, Binswanger used his results to test utility–based models with respect to the shape and the inter-temporal stability of the utility function. Under this, he looked at the way the various risk aversion measures behave as wealth and gain levels change. His experimental results showed that contrary to Arrow's 1971 prediction, relative risk aversion was not rising but instead declining. This was an important finding which negated criticism of the poor prediction capacity of Expected Utility Theory (EUT) over modest stakes which had been based on Arrow's prediction. He further examined an empirical test of asset integration using his results, by which that hypothesis was rejected. With the use of the utility function concept, economists' standard expression of utility as a function of wealth, they implicitly postulated what Kahneman and Tversky (1979) called asset integration. In simple terms it means that the decision maker is assumed to make his decisions in terms of wealth states and not in terms of gains and losses. If indeed asset integration were the case, this would favour Kahneman's Prospect theory instead of Expected Utility Theory(EUT) as a normative

and descriptive model of decision making behaviour under risk. With Binswanger's results rejecting the "Asset integration hypothesis' the above possibility was apparently ruled out.

What this implies in terms of farm behaviour and diversification is that income diversification behaviour will based on farmer wealth states. As will be shown from results in chapter 5, household diversification patterns between poor and better-off households are different. Poorer households tend to increase the number of activities in similar sectors , as a way of diversifying their incomes while richer households increase the portfolio of activities in different sectors thus increasing the share of income they derive from non-agricultural activities.

2.81 Risk estimation methodologies across studies in economic literature

In applied studies, a number of methods have been used to elicit risk attitudes but little has been known about how these methods have evolved and the merits and de-merits of the different risk elicitation methods In this section I portray a general picture across different methodologies in risk studies with a view of indicating their evolution, application, similarities and differences. In addition, relationships across risk elicitation methods are mapped out and gaps identified. This section gives a background to the multiple price list method which I use to elicit farmer risk attitudes and patience levels in the coffee marketing studies in chapter 3 .

Risk measurement methods have evolved over time in conjunction with major transitions in elicitation methods depending not only on aims the studies wished to achieve, but also on the discipline within which the studies were carried out. Though there have been marked

differences in the way different disciplines like Psychology and Economics have elicited risk attitudes, the unity in purpose (i.e. of predicting behaviour) for which the different studies are done has seen significant improvements in elicitation methods from the earlier studies undertaken by psychologists. This evolution has not only been interdisciplinary but also intra-disciplinary with marked differences between measurement methods of experimental economists, (Holt and Laury, 2004) agricultural economists (Binswanger 1980, Dillion and Scandizzo, 1978) and behavioural economists (Kahneman and Tveskey 1979). The results of these different methods across time have had significant theoretical implications and refinements on the body of economic knowledge over time.

Broadly speaking, three principal methods have been discussed in the literature in relation to the measurement of risk attitudes. These are

a) Direct estimation of the utility function. This involves interaction with the decision maker, perhaps through a structured interview, such that the subject expresses his or her preferences among various alternatives. Regression techniques are used to estimate the utility function based on these revealed preferences. An example under these is found in Dillion and Scandizzo (1978). The drawbacks with the direct estimation method; interviewer bias, the selection of probabilities, reluctance to play lottery games, lack of reality of the scenarios in place and insufficient experience on the part of the decision maker in the evaluation of hypothetical situation (Anderson et al , 2007).

b) Experimental methods ((also called the lottery method.) These involve real bets insteadof hypothetical gains and losses are used. Examples here include Binswanger (1980), Holt and Laury (2002) and Harrison et al (2007). The drawback here is the financial costs involved in providing incentives with large subject pools. In addition, it is

may challenging to get the true elicited risk assessment from the stimuli given to the subjects when financial incentives have been provided in the experiments. It may be difficult to know whether experimental subjects are responding to the financial incentives they receive during experiments or are giving true behavioural responses to the stimuli of the economic behaviour being studied in the experiment (Rydval and Ortmann, 2004) .

c) Observed economic behaviour: This method is based on the difference between observed economic behaviour and that predicted by the empirical models. The draw back here may be the failure to capture the influence of other non-monetary objectives in the decision making process (such as social preferences, leisure etc) and constraints like financial limitations and lack of technical information all of which contaminate attitudes towards risk thus confounding utility maximization behaviour.The experimental methods and the direct elicitation methods both use choice between different alternatives with different outcome probabilities. The differences are that real payoffs under a series of experimental steps are used to elicit risk attitudes with experimental methods while hypothetical payoffs are used to elicit risk attitudes by way of structured interviews with respondents. (Rydval & Ortmann, 2004) .Despite the above limitations, the experimental method involving the use of real bets, has emerged as the dominant methodology and has been widely used risk estimation studies to date, though this has not been without criticism as will be discussed later on.

2.82 Tracing the history/evolution of risk estimation methods over time

In this subsection, I describe changes in risk elicitation methods over time, identifying lineage and situating the evolving research in a larger historical context of risk and expected

utility theory. Experimental work on measurements of attitudes towards risk was first carried out primarily by experimental psychologists who used actual gambles with small payoffs and small sample sizes (Binswanger, 1980). These were followed by risk studies by agricultural economists such measured the parameters of utility functions by simulated gambling situations with hypothetical payoffs. These simulated gambling situations were abstract in that they did not take into account the context of the situation being studied as opposed to actual gambles with real payoffs and whose questions are framed using examples from the real lives of people and phenomenon under study (context) . Dillion and Scandizzo (1978) used approaches based on utility theory and elicitation of certainty equivalents, with Dillion and Scandizzo adding context to their non-incentivised elicitation by using simulated farming problems rather than pure simulated gambles. Adding context to experiments help experimental subjects to get a good understanding of the economic behaviour under study because the questions are farmed using real experiences or activities in their lives

The problems of interviewer bias, in which two investigators elicited different risk aversion distributions from two similar villages in north-eastern Brazil in the study of Dillion and Scandizzo (1978), together with the opportunity to work with larger samples in the elicitation or risk attitudes, prompted the classic experimental work on risk estimation by Binswanger (1980) with rural farmers in India. Binswanger adopted the lottery method based on one period gambles and a sequence of games, testing for effects using purely hypothetical payoffs versus a mixture of real and hypothetical payoffs, testing for learning effects by the number of rounds by which respondents learnt the rules of the game and testing for effects of asset legitimacy on the elicited of risk aversion distributions within the

large sample of 330 household heads he used. Coupled with this he controlled for experimental artefact effects by adding context to his field experiments through adapting his elicitation procedure in a way that reflected how the decision making mechanism worked among rural farmers. Experimental artefacts are behavioural responses which are attributed to the way experiment is conducted rather than the underlying behaviour that is being studied during an experimental studies. He also took into account the moral problems confronting low income people involved in gambling by limiting the worst possible gambling outcome to a zero gain rather than a loss.

Binswanger (1980, 1981) was able to replicate Dillion and Scandizzo's 1978 study using the interview method based on hypothetical payoffs with simulated farming problems to elicit certainty equivalents and consequently risk attitudes. He tested for the effects of interview bias on the elicited risk aversion distributions in the sample and indeed found that results from this method were heavily prone to this problem. Binswanger's experiment and the results he obtained marked a turning point not only on the methods eliciting risk aversion among respondents but also on the theoretical aspects on the body of economic knowledge concerning risk aversion.

In economics, empirical work with models of behaviour under risk – whether security based or utility based – usually involves comparing the models predictions with the real world decisions of a sample of individuals or firms. The advantage of this approach is that the analysis focuses on decisions that people actually must make in the course of their economic activities. The disadvantage is that it is difficult to determine the relative influence of risk and other factors on these decisions"- (Binswanger 1981). This has resulted in an interesting pattern of improvement in elicitation methods from small samples with low

(possibly unrepresentative) payoffs , to non- incentivised moderate sample sized interview based methods to elicit certainty equivalents and consequently risk attitudes. The improvements here is that as the samples get larger they become more representative but the trade-off in the evolution process is that with larger paying financial incentives to the many respondents gets heavily constrained.

Given the problems arising from payment of financial incentives, progress on risk elicitation work with moderate samples continues with introduction of context in the Brazilian interview method of Dillion and Scandizzo (1978) where they used simulated farming problems other than pure simulated gambles. Introducing context to risk experiments implies that risk attitudes are elicited taking into account the farming environment and the questions used to elicit these attitudes are framed in terms of farming decisions that farmers undertake on a daily basis. This reduces hypothetical bias that comes with asking abstract questions to respondents. Dillion and Scandizzo report that in their method, the farmer's risk attitudes were appraised via their choices between hypothetical but realistic farm alternatives involving risky versus sure outcomes, hence adding context to their method.

With hypothetical payoffs however, there are neither incentives for respondents to reveal their true preferences nor are they willing to exert more cognitive effort (resources) to understand what the interview is all about(Holt and Laury, 2004). Coupled with the absence of practice rounds to give respondents a chance to learn about the hypothetical game and payoff structure, there is likely to be confusion or uncertainty over what the interview is all about which then culminate into experimenter demand effects leading to interviewer bias.

This is what called results from Dillion and Scandizzo (1978)into question and lead to Binswanger Indian experiment which has been described at the beginning of this section.

Binswanger's classic article of 1980 marked a turning point both in the methodological aspects risk attitude elicitation and on the theoretical debate on risk at that time which turned to have wide implications for the general body of economic theory. Methodologically, Binswanger showed that incentives were important for proper risk attitude elicitation when he showed that experimental results from pure hypothetical payoffs were not usable. They only become usable once mixed with real payoffs and after several practice rounds during the experiment which further demonstrated the importance of learning during experiments.

Despite the fact he used pure simulated gambles in his experimental games, Binswanger added some context to his elicitation procedure which captured the way decision making was made among rural farmers by giving his respondents time to make decisions and also by allowing them to consult with their friends in the decision process as is usually the case with rural farm decisions, further stressing the importance of context in experimentation. He further highlighted the problems with hypothetical interview elicitation methods by demonstrating interviewer bias after replicating Dillion's study on the rural farmers in India.

2.90 Uganda's agricultural sector and its evolution over time

Between 1987 to 2005, agriculture in Uganda performed well, growing at an average 3.8 percent, faster than population growth at that time. The sector was thus a major contributor to the success of Uganda's poverty reduction efforts in the 1990s. Relative to other countries in the region, Uganda's long term agricultural growth trend has been

impressive (World Bank, 2006). This long and sustained period of growth earned Uganda the distinction of being one of the most successful countries in terms of achieving high rates of poverty reduction. It also demonstrated the success of the policy framework of a conducive macroeconomic policy environment and clear progress with stabilization and market liberalization that was adopted by Uganda.

However, the evidence suggests that, more recently, the performance of the sector has been less impressive than was expected. Real growth in agricultural output declined from 7.9 percent in 2000/01 to 0.1 percent in 2006/07, before recovering to 1.3 percent and 2.6 percent in 2007/08 and 2008/09, respectively (UBOS ,2009). This rate of growth has been below the population growth rate of 3.2 percent, implying that per capita agricultural GDP has been declining. It is also far short of the 6 percent growth target for the agricultural sector set by African Governments under the Comprehensive Africa Agriculture Development Program (CAADP).

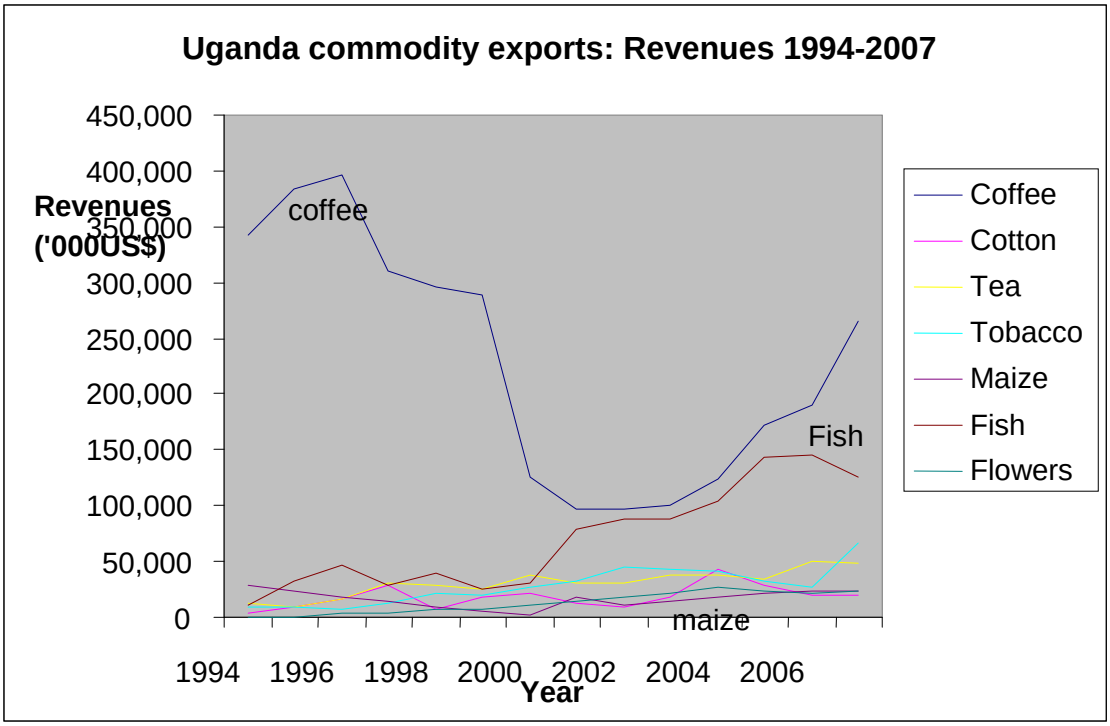
Agriculture exerts considerable influence on overall GDP Growth. While the share of agriculture in GDP has declined as industry has grown, it still made up 21 percent of the observed growth between 2001-2005 and also accounts for a significant proportion of growth indirectly, that is through forward and backward linkages with the service and industrial sectors (World Bank, 2006).The decline in growth was evident in all the sub-sectors of agriculture. Given that 73 percent of all households in Uganda are engaged in agriculture, a declining performance matters greatly for their livelihoods and represents a setback in the drive to eradicate poverty and create wealth (Uganda National household Survey report, 2006)

2.91 Commodity exports trends in Uganda(1994-2007)

Figures 1, 2 and 3 below show the trends in revenues, export volumes and the unit values of Uganda's major agricultural commodity exports between 1994 and 1997. Although coffee was still the highest export revenue earner during this period, coffee revenues had a sharp decline from peak of 400 million US dollars in 1995 to a minimum 100 million US dollars in 2001. These revenues remain low and only recovered after 2003 rising again to about 250 million US dollars per annum in 2007. The fall in coffee revenues during this period coincides with a steady decline in both export volumes and unit values (prices) during the same period. Coffee export volumes declined from 300,000 tonnes per annum in 1995 to about 200, 000 tonnes per annum in 2007. Compared to export volumes, the trend in coffee revenues was followed much more closely by the trend in coffee unit values during the same period indicating that prices may have been a bigger influence than volumes in Uganda's total coffee export revenues .

Fish, a non-traditional export commodity, was the second highest source of export revenues after coffee between 2000 and 2007. Despite the nearly constant fish exports between 1994 and 2007, the unit values of fish exports had a steady increase over the same period implying that increased fish export prices were a major factor in the increased revenues. Uganda mainly exports her fish to the European Union.

Figure 1



Cotton which was a major cash crop after coffee during the 1970s and the 1980s had consistently low revenues, low export volumes and low prices over the study period. Flower exports volumes surged between 1994 and 1996 and then declined greatly after 1997, remaining low over the 1998 and 2007. The reason for this is that at the introduction of the flower industry in Uganda, a number of players entered the market but soon experienced problems of the high production costs involved in producing flowers and transporting them to the Amsterdam auction forcing some flower farms to close.

Figure 2

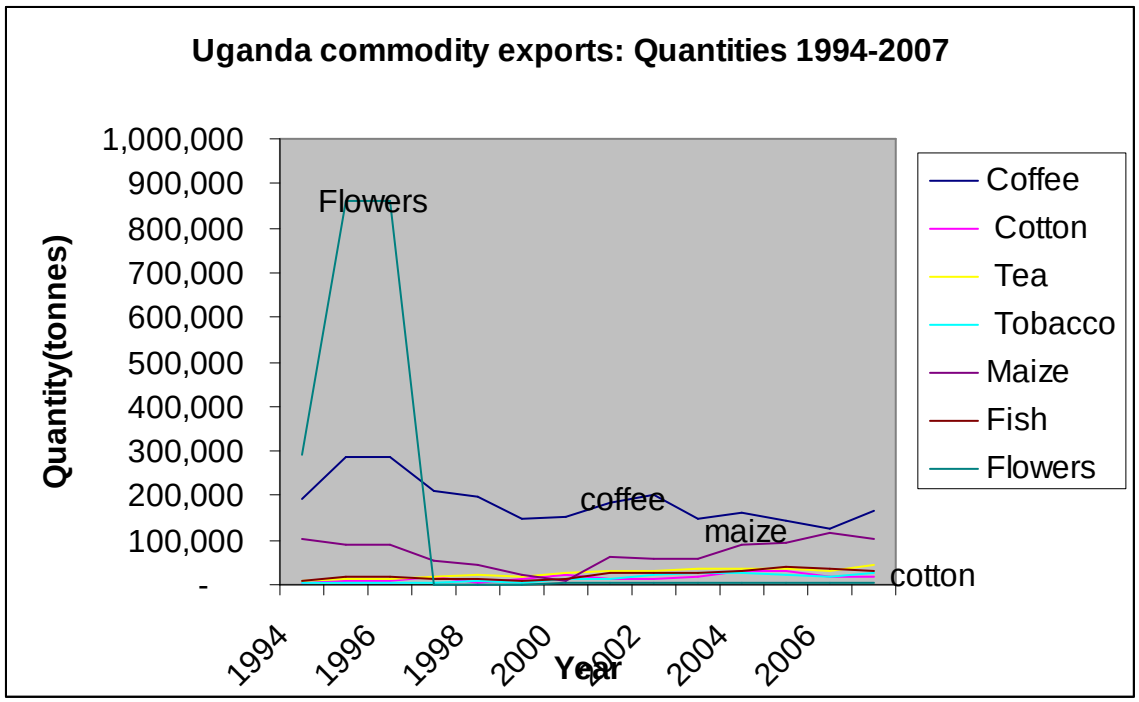
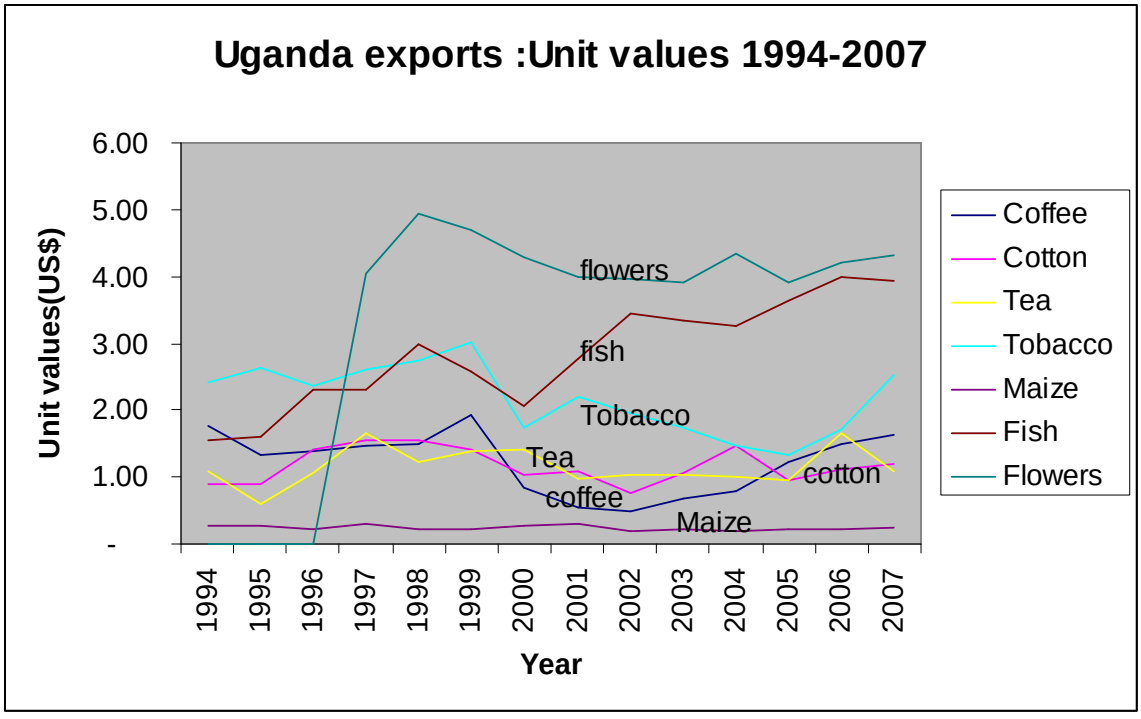


Figure 3



Source: Authors graphs based on UBOS data

Tea had a relatively steady export revenues and volumes during this period given that neither production area nor price s of tea varied that much between 1994 and 2007

Figure 4: An Administrative Map of Uganda

CHAPTER 3

The Impact of Marketing Strategies on Cash Crop Incomes under Price Risk: Evidence from Coffee-Producing Households in Uganda

3.0 Introduction

In this study, the determinants and effects of coffee sales decisions are studied using data from a survey conducted among 700 coffee-producing households in Uganda between March and August 2008. My results show that impatience, cash constraints, scale of production, and knowledge drive coffee marketing decisions and also change marketing behaviour. The results in this chapter show that, although market liberalization allows farmers to increase their revenues, lack of credit has implied that this potential remains largely unrealized**.** The findings also provide evidence of varying transaction costs among rural households and their effects on household incomes. This implies policies aimed at improving rural incomes from the sale of agricultural commodities and reducing vulnerability should be specifically targeted to cater for the needs of different farmer groups.

Despite Uganda's relative success in structural adjustment, the traditional commodity sector has performed poorly over the last fifteen years. This has resulted in persistent rural poverty and under-performance of the economy as a whole. A large trade deficit persists and it has been suggested that the poor performance of the agricultural sector is the key explanation for this imbalance (Belshaw et al 1999).

Part of the problem has been the combination of price risk and what were at least until recently persistently low world commodity prices in commodity markets. Uganda is a major producer of robusta coffee. The 1989 cessation of the International Coffee

Organization's quota coffee export controls followed by major production increases in Brazil and Vietnam, not matched by consumption growth, led to extended periods of low prices in world markets (Gilbert 2005). Coffee was Uganda's main source of foreign exchange earnings but between 1997 and 2001 coffee export revenues fell sharply with robusta experiencing a decline of over 55% and arabica experiencing a 40% decline in export revenues (UCDA, 2001)[2]. Over the last seven years, coffee prices have recovered from their 2001-03 low levels, but rising food prices and increasing inflation have eroded real coffee incomes.

The other part of the explanation lies in the market structures and institutions which arose after liberalization, in particular as the consequence of the entry of private traders into Uganda's agricultural markets. Liberalization not only spurred market entry but also reduced the number of producer cooperatives, as increased competition from private traders rendered cooperatives uncompetitive .A liberalization objective was to allow coffee producers to receive a larger share of the export price and this has indeed resulted. According to Collier and Reinikka (eds *Uganda's Economic Recovery,2001)*, producer prices received by coffee growers increased sharply, both in absolute terms and as a share of border prices from between 20 and 30 percent to more than 80 percent as a result of increased competition. With liberalization, farmers who used to supply coffee to the primary cooperatives on credit, are now paid in cash. However liberalisation also increased the extent to which fluctuations in the world coffee price are passed from exporters to producers – a so-called "second generation" problem (Akiyama and Varangis, 1995). Greater price fluctuations at all levels of the marketing chain imply an increase in price risk faced by

[2] Arabica and Robusta coffees are grown in the ratio of 1: 4, implying that Arabic coffee covers a small area in Uganda. (UCDA, 2010).

market participants, with producers bearing most of it (Hill, 2006). Most intermediation costs are fixed dollar costs and are therefore independent of the price level. Given an unchanged volatility at the exchange level, price variability, as measured by the coefficient of variation or log standard deviation, will therefore be higher the further down the chain one goes.

Prior to liberalization, producer cooperatives not only marketed coffee but also advanced production and consumption credit to coffee producers. The reduction in the number of cooperatives, together with the reduced resources of those that survived, has left many poor farmers without access to credit. However credit was in both directions; first to cover farm inputs but also in terms of consumption credit since farmers under cooperatives used to get payments for their coffee long after the actual sales transactions. Faced with increased price volatility, poor households with no collateral are unable to borrow against future income (Beck and Demirgùç-Kunt 2008). Micro-credit is poorly developed in rural Uganda, perhaps because, even when they are credit-worthy, poor households seek loans that are too small to be profitable at common interest rates (Johnston and Morduch 2008).

The combination of increased post-liberalization price volatility, relatively low real coffee prices and the pervasive lack of credit has generated changes in the way coffee-producing households market their coffee. These marketing changes are the subject of this paper. My main reference point was Fafchamps and Hill (2005) who used Ugandan producer survey data collected in 2002 to analyze farmers' decisions about whether to transport their coffee to the market or sell to itinerant traders (*debbe boys*) at the farmgate. They found that selling to the market is more likely when a large quantity is sold and the market is

relatively close. I argue that coffee sales decisions have become more complicated over the intervening period than at the time of the Fafchamps and Hill survey. Coffee is now not only sold as dried coffee cherries but also increasingly in other forms and through other outlets. Specifically, small credit-constrained coffee producers, faced with consumption risk, sell a substantial portion of their coffee in both raw and dried forms depending upon the consumption needs of the households during the marketing season. Households selling raw coffee cherries often obtain poor prices from village traders who appear to be taking advantage of their situation (Hill 2007). This can exacerbate poverty as can be seen with their lower unit values when compared to processing households. In addition, some large-scale coffee producers sell dried cherries in the market (stores) while others bulk the dried cherries and transport them to coffee hullers where they sell it in processed form. Small to medium coffee-producing households sell both raw and dried cherries at the farm gate and in the market in varying proportions.

Building on the work of Fafchamps and Hill (2005) and Hill (2007), I set out a model which reflects the increasing complexity of household strategies in coffee marketing in order to study the factors that underlie these household strategies and determine how these strategies affect unit values and subsequently, household coffee incomes. Analyzing sales mode decisions and their financial implications may help in identifying strategic areas of local action to prevent income losses by households in cash crop markets. Coffee marketing decisions have major implications for poverty alleviation and analyzing them gives insights on specific resilience measures that can be used to reduce the effects of price risk on the conduct and performance coffee markets.

This chapter is organized as follows. The next section presents the conceptual and theoretical frameworks underlying the study. Section 3 describes the survey data while section 4 gives the econometric estimation of the decisions taken by households in the coffee supply chain. Section 5 describes econometric analysis and results, and section 6 concludes.

3.10. CONCEPTUAL AND THEORETICAL FRAMEWORKS

3.11 The conceptual framework

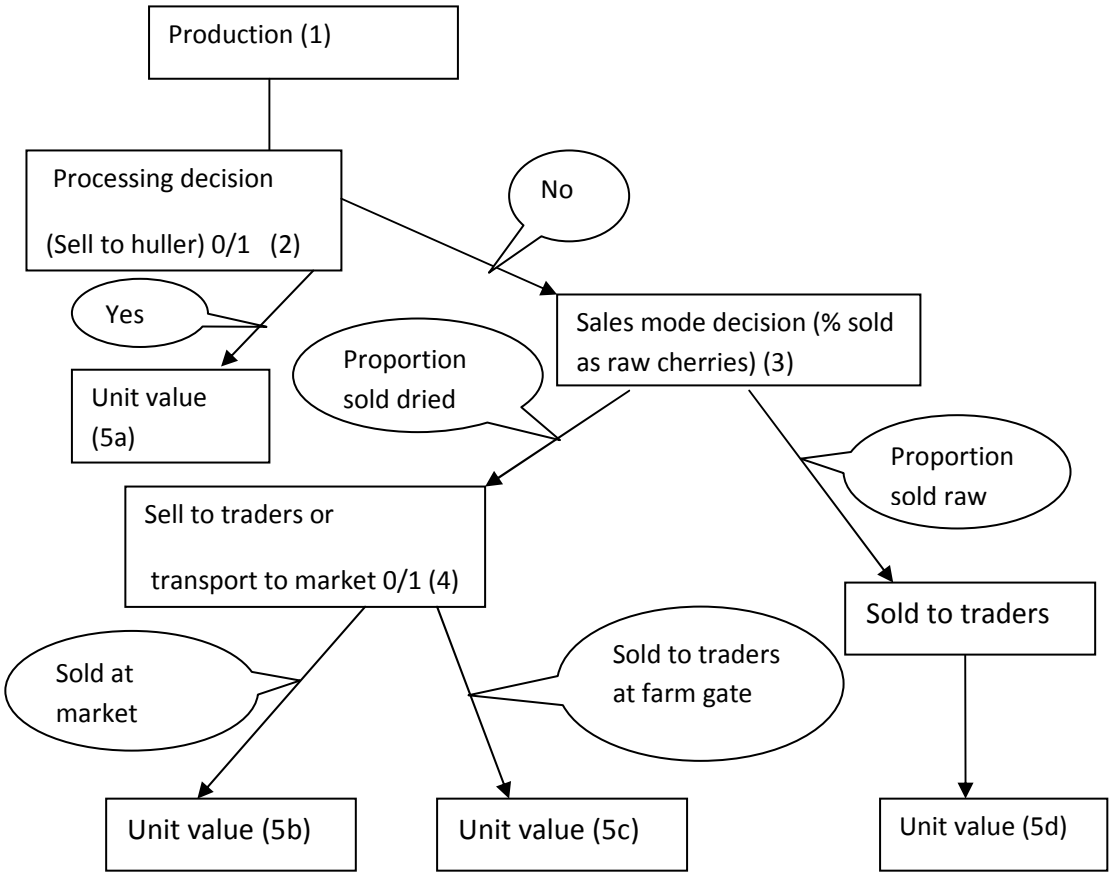
The modelling framework developed in this chapter aims to reflect the decisions made by farmers at each stage of the processing and marketing decision. The structure of the decision process and the resulting outcomes are shown in Figure 1.

The model takes production decisions as predetermined. Investment and input decisions are made prior to harvesting and in any case, in the Ugandan context, non-labour input requirements are small. Nevertheless, it is useful to include an equation for production in order to check whether it is indeed valid to condition on this outcome. I assume that it is always profitable to pick all the coffee produced. However, in the presence of low prices and volatile prices it is optimal for farmers to keep trees but not to pick the coffee they produce (Hill 2010, AJAE 2010). This assumption that all the coffee produced is harvested is made for the purpose of focusing the analysis on the marketing decision.

Therefore, given the crop, the first substantive decision faced by the farmer is whether to process his coffee prior to selling it or alternatively to sell it in unprocessed forms. Households that process their coffee must carefully pick and thoroughly dry their

coffee in order to obtain a good out-turn after subsequent de-husking at the hullers. They may also bulk small quantities over the season in order to obtain larger quantities and benefit from reduced unit transport and processing costs involved in de-husking. In practice, farmers who process also aggregate. I therefore do not distinguish the picking and bulking decisions. Processing households obtain unit values denoted by Box 5(a) in Figure 1.

Figure 1: The conceptual framework



Farmers that choose not to process can sell their coffee either as dried coffee cherries (*kiboko*) or as raw coffee cherries (*embisi*) or in a combination of these forms. They may do this at various times through the season. Households that sell dried coffee cherries (*kiboko*) must decide whether to sell it in a local market or at the farm gate. Those that sell dried

coffee cherries at market obtain the unit values given by Box 5(b) in Figure 1 while those selling dried cherries at the farm gate obtain unit values given by Box 5(c). Households who sell raw (i.e. undried) coffee always do so at the farm gate to village to itinerant traders. This is because the marginal cost of drying coffee is low and hence, if they were able to wait to take their coffee to market, it would also pay them to dry their coffee. They obtain the unit values given by Box 5(d).

There are thus four possible outcomes.

1. Aggregate, process and sell to hullers.
2. Sell unprocessed dried coffee at market.
3. Sell unprocessed dried coffee at farmgate
4. Sell unprocessed raw coffee at farm gate.

In principle, farmers can mix these strategies. In practice, farmers who choose to process and aggregate do so with their entire output. Similarly, farmers who dry their coffee either sell at the farm gate or sell at market. However, a large number of farmers sell a proportion of their coffee in raw form and the remainder dried, either at the farm gate or at market.

3.12 Risk aversion and Coffee Marketing decisions

Given that risk aversion and farmer patience levels may play a substantial role in the marketing and processing decisions in the coffee value chain, it is necessary to capture information on farmers' risk aversion and patience levels. Some experimental methods use incentives in eliciting attitudes towards risk such that respondents trade-off pay-offs obtained from choosing options with risky outcomes with safe or certain outcomes. Due to the constraints involved in paying incentives, the samples involved are usually small and

unrepresentative. Dillion and Scandizzo (1978) used simulated farming problems other than pure simulated gambles. They report that in their method, the farmer's risk attitudes were appraised via their choices between hypothetical but realistic farm alternatives involving risky versus sure outcomes, hence adding context to their method. Elicitation of risk attitudes and farmer patience levels in this chapter is achieved by giving farmers different hypothetical scenarios with no incentives, but adding context to the scenarios and using the language used by coffee traders to add context to the scenarios as was done in Binswanger's Indian experiment (Binswanger, 1980) . The elicitation of framers' risk and patience levels in this study is an important advance in the coffee marketing literature relative to Fafchamps and Hill's work of 2006.

3.2 A model of the Coffee Marketing Chain

I index the four possible coffee marketing modes 1-4 (1 = processed, 2 = unprocessed, dried, at market, 3 = unprocessed, dried, at farm gate, 4 = raw at farmgate). Let the p_i and q_i be respectively the price obtained by selling in mode i where $p_1 > p_2 > p_3 > p_4$ and the quantity sold in this mode. $q = \sum_{i=1}^{4} q_i$ is equal to production which I take as exogenous to the marketing decision. i.e. the farmer has total production q which he needs to divide between these four modes. In addition, the coffee sales modes have different characteristics.

Processing requires capital expenditure (or rental) k. If this capital is available, I suppose that there is zero marginal cost of utilization. Drying does not require capital (beans are lain out to dry in the sun) and also incurs zero marginal cost. Selling coffee at the market implies a transport cost of c. For simplicity, I suppose the unit transportation cost is the same for processed and dried coffee beans. The crucial difference between the marketing modes lies

in their time cost. Normalize by supposing that raw beans are sold at time t_4 = 0, the first sales opportunity. Drying implies farm gate sales at time t_3 or market sales at time t_2. Processing requires aggregation over the entire season with sales at time t_1. I take $t_1 > t_2 > t_3 > 0$. If the farm household discounts at rate ρ, net revenues *R* discounted to time 0 are

$$R = e^{-\rho t_1}(p_1 - c)q_1 - k(q_1) + e^{-\rho t_2}(p_2 - c)q_2 + e^{-\rho t_3}p_3 q_3 + p_4 q_4$$

Processed coffee gives the highest price p_1. However, processing requires both skills and capital equipment. This is because coffee requires both access to knowledge on how to carefully pick only ready cherries rather than strip branches, and the availability of adequate labour in order to get a good out-turn from the processed coffee. Neither can be acquired in a short period of time and without investment of time and money. If they are to obtain this high price, farmers must invest in acquiring this human and physical capital and that decision. Having made that investment, the marginal cost of obtaining the additional return to processing will be small. We would therefore not expect to see farmers who have access to processing resorting to sales in other modes.

The choice between selling dried but unprocessed coffee at market (mode 2) or at the farm gate (mode 3) has been analyzed by Fafchamps and Vargas Hill (2005). The famer will obtain a higher price $p_2 > p_3$ by selling at market but will incur additional transport costs *c* in transporting to the market. The farmer will minimize these costs by aggregating his coffee to eliminate the necessity of multiple trips. This suggests that there may also be a time cost in selling at market. Suppose selling at market requires additional time τ and that the farmer

discounts at rate δ. If the prices p_2 and p_3 are both known with certainty, he will prefer to sell at market if

$$e^{-\delta\tau}\left(p_2 - c\right) > p_3 \qquad (1)$$

If inequality (1) is reversed, he will prefer to sell at the farm gate. If we ignore the possibility of equality, which would leave him indifferent between the two modes, he will not split sales of unprocessed dry coffee between the market and the farm gate. In practice, the farmer will be confronted with a known price p_3 at the farm gate which he will need to compare with a still uncertain market price p_2. Mobile telephony implies that farmers probably do have an accurate idea of current prices on local markets but the price p_2 will remain uncertain because market prices may change over the time interval τ. Taking the price variance to be σ^2 at an annual rate and supposing serial independence of price changes, the uncertainty is measured by $\tau\sigma^2$, which we may take to be small If the famer has relative risk aversion ρ, inequality (1) is replaced (to a first order approximation) by

$$e^{-\delta\tau}\left[\left(1-\rho\tau\sigma^2\right)p_2 - c\right] > p_3 \qquad (2)$$

The choice between selling at market and the farmgate therefore depends on both the farmer's risk aversion and his discount rate. Write $p_d = \max\left(e^{-\delta\tau}\left[\left(1-\rho\tau\sigma^2\right)p_2 - c\right], p_3\right)$, the certainty equivalent price the farmer obtains from selling unprocessed dried coffee.

The farmer does not incur direct costs in drying his coffee – beans are lain out to dry in the sun – and if coffee is sold in raw form (mode 4) at the farmgate, this will be at a know price p_4. The advantage of selling raw is thus that the farmer obtains the price p_4 earlier than the certainty equivalent price p_d he obtains from selling dried coffee. Let the time between raw and dried farm gate sales be η. Then the farmer will prefer to sell his coffee in raw from if

$$p_4 > e^{-\delta\eta} p_d \qquad (3)$$

(despite the fact that $p_4 < p_d$). If inequality (3) is satisfied, he will sell his entire crop *q* raw.

Despite this, if the reverse inequality holds, the farmer may nevertheless sell part of his crop raw for liquidity reasons. To see this, suppose coffee is the famer's only cash crop and that $p_4 < e^{-\delta\eta} p_d$ making raw sales *ex ante* unattractive. In the previous crop year, the farmer will have received a revenue *y*, say, from coffee sales which will have financed his cash requirements throughout the remainder of the year. Suppose at the date he is approached by a trader (or that he himself approaches a trader) in relation to a raw coffee sale his cash balance has reduced to *b*. Now suppose he experiences a large expenditure shock (typically a health related expenditure) requiring him to spend *s* > *b*. If he has no access to credit, the only way he can finance this expenditure is by selling raw coffee. In effect, the trader is lending him money against the collateral of his raw coffee. But because raw coffee sales are unattractive, the farmer will sell the minimum quantity $q_4 = \frac{s-b}{p_4}$ in raw form and will retain $q - q_4$ to sell dried. If there is a probability π of an expenditure shock *s* > *b*, the famer will mix raw and dried sales with the probability.

To complete this discussion, we need to specify the likely cash balance *b* at the date of possible raw coffee sales. The simplest case is that in which the farmer spreads his planned cash outlays evenly over the year. In that case, and supposing that the farmer experiences at mot one expenditure shock in a year, we would have $b = (1-\eta)y$. However, a risk averse farmer would wish to conserve a greater cash balance than this to reduce the probability

that he will need to resort to raw coffee sales. A formalization of this proposition is relegated to appendix 2 of this chapter.

In summary, the model implies the following outcomes:

i) Farmers with low discount rates and/or who possess processing equipment will sell their entire crop in processed form.

ii) The remaining farmers may either sell their crop entire as dried coffee or entirely as raw coffee, or may divide their crop between these two modes. Sale of raw beans will be associated with high discount rates, possibly arising from the impact of credit constraints in conjunction with urgent expenditure requirements.

iii) The decision as to whether to sell dried coffee at the market or at the farm gate depends on the balance of the additional (time and travel) costs of selling at market in relation to the higher price obtainable at market. Farmers who are further from market and/or less patient will sell at the farm gate. We should not expect to see farmers mixing farm gate and market sales of dried coffee.

3.30 DATA AND DESCRIPTIVE STATISTICS

Data were collected in a survey conducted between March and August 2008 of 700 coffee-producing households in the central Ugandan districts of Mukono and Kayunga which are among the principal growing areas for robusta in Uganda. Households were sampled using the stratified random sampling technique where the numbers of households selected for interviewing were proportional to coffee growing intensity of the selected villages. The major items of interest of the study were coffee markets, price risk attitudes and incomes:

a) Data on coffee markets included (i) the form in which the household usually sold coffee (i.e. dried, wet or processed), the market agent to whom the sold coffee was sold (itinerant traders, coffee stores and coffee hullers), and coffee quantities sold and sale prices for the last two transactions.

b) Price risk: risk taking ability and patience levels were elicited in order to capture the level of risk that farmers could take in the coffee value chain. Patience was elicited to capture farmers' willingness to undertake speculative storage while risk bearing ability was elicited to determine farmers' willingness to pay for price stability. Patience was captured as an ordinal variable measured on a scale of 0-5 from very impatient to very patient households using the multiple price list method. To capture coffee price risk-bearing ability, farmers were presented with a scenario in which they had to choose one out of five reputable companies that approached them to make a buying contract *a priori*. All the five contracts were designed in such a way that they had varying levels of a trade-off between safe but lower coffee prices and high but uncertain coffee prices. Through this trade-off process, the choice of contract gave an indication of the risk bearing ability which was recorded as an ordinal variable.

c) Income data was estimated from the previous season's coffee sales, and from other farm and non-farm activities. Wealth variables included the market values of the livestock, land and the house owned by the household. Other household characteristics captured included farm size, coffee acreage, school enrolment levels, household size, demographics and labour allocation.

3.31 Descriptive statistics

i) Markets: As shown in Table 1, 12 percent of the sampled households sold all their coffee as raw cherries and 34 percent sold coffee as dried cherries. 48 percent sold coffee as both raw and dried cherries in varying proportions while only 6 percent of the households sold processed coffee. Households that processed their coffee sold higher mean coffee quantities (464 Kg/season), obtained higher mean unit values (2953 Shs) per kilo of coffee sold and tended to be further away from trading centres compared to non-processing households.

Compared to the sample mean quantities and unit values of 310 Kg/season and 1014 Shs per kilo respectively, processing households produced 50% higher coffee quantities and captured three times the value per kilo of coffee. ii) Production: Tree stock and land allocated to coffee production increase as one moves from non-processing to processing households. Raw coffee-selling households allocated about 1 acre of land (which is below the sample average of 1.37 acres) while processing households allocated 2 acres of land to coffee production on average.

Table 1. Descriptive Statistics of Coffee Markets, Production and Households across Sales Modes

Variables	Sample averages	Coffee sales mode			
		Raw coffee only	Dried and raw coffee	Dried coffee only	Pro-cessed coffee
a) Characteristics of the coffee markets					
Quantity sold (Kg of dried coffee equiv.)	310	289	285	266	464
Unit value (Shs/Kg)[3]	1015	424	847	1054	2953
Bicycle ownership (#)	522	60	172	282	40
Distance from trading centers(miles)	2.32	2.16	2.02	2.48	3.02
b) Characteristics of coffee production					
Tree stock (No. of trees under production)	267	136	202	323	463
Land under coffee production (acres)	1.37	0.98	1.17	1.53	2.05
Total land owned (acres)	3.82	2.75	3.94	3.76	5.94
Coffee productivity (Kg/acre)	340	534	379	268	294
Tree intensity (No. of productive trees/acre)	227	204	212	235	293
c) Household characteristics					
Household size	8.00	7.02	8.12	7.96	7.53
No. of children below 5 years	1.47	1.28	1.64	1.43	1.35
No. of schooling years of household head	5.87	4.51	5.69	6.12	7.73
School enrollment	3.53	3.10	3.73	3.45	3.95
Household wealth (000 Shs)	4,689	3,588	4,558	4,836	6,608
Income from food sales (000Shs)	175	53	282	135	134
Seasonal income from other activities (000 Shs)	124	108	149	104	179
Patience level of farmer (ordinal; 1-4)	1.75	0.80	1.49	2.09	2.53
Risk aversion level of farmer (ordinal; 0-5)	3.51	3.94	3.58	3.41	3.10
No. of households in each sales mode	700	87	235	338	40
% households in each sales mode		12%	34%	48%	6%

Despite allocating larger proportions of land to coffee production and having higher average tree stocks and intensities, larger coffee producers had a relatively lower coffee productivity

[3] In this table, unit values are classified only by sales mode and not sales location. For this reason, values may different when the classified by both coffee sales mode and coffee sales location

than smaller producers. This may be an indication of the inverse relationship between farm size and farm productivity.

Households; Though households show a mixed pattern across sales modes groups in terms of size and young children, the coffee processing level at sale increases with average education levels. This pattern indicates the potential impacts of education and knowledge on seasonal household incomes induced by patience formation (lower discount rates) and availability of other incomes sources that come with increased education levels. As expected, households selling coffee in more advanced forms have relatively higher wealth levels than non-processing households. However, the household incomes among sales mode groups show a mixed pattern indicating potential effects of income diversification on household incomes. It could be the case that for some households, incomes from other activities are more important than income from coffee sale. Looking at farmers' risk attitudes and time preferences, farmers who sell coffee at higher processing stages are on average less risk averse and more patient than their counterparts who sell coffee at lower levels of processing.

3.32 Coffee sales mode and farmer patience level

It seems plausible that the farmer's sales decision will be linked to his degree of patience. Table 2 provides a cross-tabulation of sales decisions and elicited patience levels. The Pearson chi-squared test decisively rejects the hypothesis of no association. Inspection of the top row of the table reveals that the majority of farmers who sold raw and dried coffee exhibited high elicited impatience levels though the reverse is not true (not all highly impatient farmers made this sales decision) implying the importance of other factors in sale mode decision besides patience. A high value for Cramers' *V* values shows a strong

association between coffee sale mode and farmer patience above and therefore motivates the inclusion of discount rates in the theoretical model below.

Table 2: Relationship between coffee sales mode and farmer patience level

Sale mode	**Farmer Patience level**						**Total**
	Very Impatient	**Slightly impatient**	**Impatient**	**Quite patient**	**Patient**	**Very patient**	
Raw coffee #	68	0	7	1	7	5	88
row %	77.27	0	7.95	1.14	7.95	5.68	100
Dried&Raw coffee #	136	2	34	11	13	39	235
row %	57.87	0.85	14.47	4.68	5.53	16.6	100
Dried coffee #	148	9	48	26	11	96	338
row %	43.79	2.66	14.2	7.69	3.25	28.4	100
Processed	12	2	7	3	4	12	40
row %	30	5	17.5	7.5	10	30	100
Total	364	13	96	41	35	152	701
%	5	1.	13.	5.		21.	100
Pearson χ^2_{15} = 62.7291 with tail probability 0.000							
Cramér's V = 0.1727							

3.40 Econometric specification

a) Econometric estimation of the production function

The model set out in section 3 takes production as exogenous. It is nevertheless useful to specify an equation for coffee production in order to check the validity of this assumption in the estimates that follow. I suppose that coffee production (*Q)* is a function of the proportion of the land households allocate to coffee production *Area,* the amount of labour allocated to coffee production *Labour*, the stock of coffee trees under production *Tree stock*, and the farming experience of the farmer in years, *Farmexper.* I assume that the prevailing coffee price in the market does not influence production in the short run. This is because coffee is a perennial tree crop which takes 3-4 years to get into full production after planting.

$$Q = f\,(Area,\ Labour,\ Tree\ stock,\ Farmexper,\ Capital).$$

I specify a log-linear functional form for the coffee production function in order to capture the coefficients as elasticities of coffee supply to the changes in the factors of production, and to determine the nature of returns to scale in coffee production. A quadratic term *lnTreeSq* is added to capture the effects on production as farm size increases. I also include a term interacting the tree stock and area to capture the possible impact of coffee wilt disease, which is endemic in the area studies, and is likely to be most severe where production intensity is high.

$$\ln Q = \beta_0 + \beta_1 \ln labor + \beta_2 \ln Area + \beta_3 \ln Trees + \beta_4 Exper + \beta_5 \ln TreesSq + \beta_6 \ln Trees \times \ln area \quad (8)$$

The labour input is likely to be endogenous and may also be misreported. I therefore estimate the equation by Instrumental Variables using the number of working age adults in the household as the instrument.

b**) Econometric estimation of the processing decision**

Let *Process* denote the decision on whether to process coffee, with *Process* = 1 if processes and *Process* = 0 if the household does not process coffee. This decision depends on a latent variable Y_p^*, where *Process* = 1 if Y_p*≥ 0 and *Process* = 0, otherwise.

The model set out in section 2, and specifically reflected in equation (2), suggests that the probability that a farmer will process his own beans will depend

- positively on the size of his crop *Q* – high production makes it easier to cover the fixed costs of processing;
- negatively on household wealth *Wealth* – wealth raises the opportunity cost of time (Fafchamps, 2005);
- negatively on distance to market *Mktdist*;
- positively on the farmer's patience level.

Farmer patience is captured by the elicited patience measure *Patience* while the number of children in the household enrolled in the education system, *Enrol* is an additional factor measuring possible requirement for immediate funds. The need to cover school fees and other educational expenses is one crucial factor which may lead farmers to sell coffee beans early in the season. I also include an interaction term between wealth and quantity sold in the estimated equation to get an indication of how the processing decision varies with coffee quantities sold as wealth increases.

The specification is

$$Y_p^* = \beta_0 + \beta_1 \ln Q + \beta_2 Mktdist + \beta_3 Patience + \beta_4 Riskaversion + \beta_5 Enrol + \beta_6 Wealth + \beta_7 (Q \times Wealth) + u \quad (9)$$

where u is an error term. Taking this error to be normal allows estimation by probit, i.e.

$$\Pr\left(Process = 1\right) = \Phi\left(Y_p^*\right) \quad (10)$$

where $\Phi(.)$ denotes the standard normal distribution function.

Since the processing decision is conditioned on coffee production *Q*, there is a potential endogeneity problem. Possible endogeneity of quantity of coffee produced Q, in the processing decision arises from unobserved heterogeneity among farmers that affects both production and processing decisions. Dagenais (1999) has shown that modelling discrete choices on endogenous variables using instrumental variables is inconsistent and may give misleading results. This is because, due to nonlinearity of the probit (or logit) estimator, the index function Y_p^* is correlated with the disturbance term *u* even if the disturbance term is uncorrelated with the vector of instruments. These problems are avoided by reverting to a linear probability model (LPM). A Hausman test between IV and LPM estimates is undertaken to test for endogeneity of the quantity produced in the processing decision. The instruments set is implied by the production function specification (8).Failure to reject the null hypothesis that there is no systematic difference between IV and LPM estimates validates use of the probit estimates for the processing decision as implied by equations (9) and (10).

(c) Econometric estimation of the proportion of coffee sold raw

Farmers who do not process their coffee must choose the proportion that they sell raw. Raw coffee sales are usually crisis sales aimed at generating cash in order to smooth consumption against shocks such as sickness, drought and school dues. Sometimes traders advance credit to rural farmers in lieu of their standing coffee crop prior to harvesting while other farmers sell small quantities of raw coffee while drying the bulk of the coffee to pay school fees later in the season. Some small producers end up selling all their coffee raw since the small quantities involved may not make waiting to dry coffee cherries worthwhile. The model set out in section 2, and specifically reflected in equation (5), suggests that the proportion of beans that the farmer will sell in raw form will depend on the extent to which the household is constrained. Thus, raw coffee sales *Rawcherries* as a proportion of total sales are likely to be negatively influenced by household wealth *Wealth*, and the share of cash income in total income (*otherinc*), and positively on urgent household consumption needs during the season. In practice, urgent expenditures generally relate either to health or education. I use the proportion of school going children in the household *Enroll* as a proxy for household schooling requirements and the proportion of children aged below five years *pKids* is used as a proxy for household health needs. Inherent characteristics of the household head such as the education, farming experience, plus risk and time preferences may also affect the decision to sell raw coffee. Increased distance from markets is likely to increase sales of raw coffee because more remote households tend to have fewer alternative incomes sources besides coffee when compared to households near trading centres.

The specification is

$$Rawcherries^{*} = \beta_0 + \beta_1 Wealth + \beta_2 Q + \beta_3 pEnroll + \beta_4 pKids + \beta_5 Patience + \beta_6 Mktdist + \beta_7 Riskaversion + v \quad (11)$$

where *v* is an error term which I again take as being normally distributed.

The variable $Rawcherries^{*}$ is latent and is related to the observed variable *Rawcherries* by

$$Rawcherries = \begin{cases} 1 & Rawcherries^{*} \geq 1 \\ Rawcherries^{*} & 1 \geq Rawcherries^{*} \geq 0 \\ 0 & Rawcherries^{*} \leq 0 \end{cases} \quad (12)$$

which defines a double censored Tobit with left censoring at zero and right censoring at one (Wooldridge 1999). Since the equation is estimated over households who do not process their beans, it is also necessary to correct for possible sample selection bias. I test for selection bias by adding the inverse Mills ratio generated from the probit processing regression (10) as an additional regressor in the Tobit regression for the proportion of raw cherries sold.

(d) Econometric estimation of the sales location equation

Households that sell dried cherries have to decide on whether to transport their coffee to the market or sell to itinerant traders at the farm gate. The model set out in section 2 suggests that the decision to sell at market will depend on transportations costs. This implies that this probability should depend negatively on distance *Mktdist* and positively on ownership of a bicycle or motor cycle *Transport*. In order to replicate the equation estimated by Fafchamps ad Hill (2005), I also include the log of quantity sold ln*Q*, the log of wealth ln*Wealth*, the square term of the log of wealth ln*WealthSq* and an interaction term between quantity sold and household wealth. This is because wealthier households may not

sell their coffee to the market despite producing large coffee quantities due the opportunity cost of their time invested in other income activities (Fafchamps 2005). The square term captures likelihood of selling to the market as wealth increases while the interaction term captures the opportunity cost of farmers' time. The model implies that households will either sell dried cherries at market or at the farm gate so the dependent variable is binary: *Market* = 1 if the sale is at market and zero otherwise. Again taking the error term as normal, we obtain the probit specification

$$\Pr(Market=1)=\Phi(\beta_0+\beta_1\ln Q+\beta_2\ln Wealth+\beta_3\ln WealthSq+\beta_4 Transp+\beta_5 MktDist+\beta_6 Patience+\beta_7 Riskaversion) \quad (13)$$

I check for possible endogeneity of production by performing a Hausman test to compare LPM and IV estimates using the instruments implied by the production function specification (8). The equation is estimated on non-processing households and I therefore add the inverse Mills ratio from the estimates of equation (10) to allow for possible sample selection bias, as in the location equations (11) and (12) .

(e) Econometric estimation of coffee unit values

The survey data allows inference on the undiscounted unit value *uv* of coffee produced across all sales modes for each coffee-producing household. In terms of the variables defined in the preceding discussion, equation (1) allows us to write this unit value as

$$uv=p_1.Process+\left[\left(p_2.Market+p_3.(1-Market)\right).(1-Rawcherries)+p_4.Rawcherries\right].(1-Process) \quad (14)$$

Here the prices $p_1,\cdots,p_4$ are parameters to be estimated. These are not directly estimable since many households market using a combination the various modes. However, the variables in equation (14) are exactly collinear since

$$Process+(1-Process)\left[Rawcherries+(1-Rawcherries)(Market+(1-Market))\right]=1$$

It is therefore only possible to estimate three of the four prices in equation (14). I circumvent this problem by defining the discount $Discount=\overline{p}_1-uv$ that the household accepts relative to the average unit value obtained by households which process their coffee. I therefore estimate

$$Discount=(1-Process)\left[\left(\delta_2 Market+\delta_3(1-Market)\right).(1-Rawcherries)+\delta_4 Rawcherries\right] \quad (15)$$

where $\delta_j=p_j-\overline{p}_1$ (j=2,3,4) . This normalization can be justified since households that process their coffee use less or none of other marketing modes.

In an extended specification I interact the two farm gate prices p_3 and p_4 with market distance to allow for the traders' transportation costs and also include market distance and wealth as independent regressors. Due to possible endogeneity of the sales mode decision, OLS estimation of the unit value equation a may be inconsistent. In order to test for the misspecification that could result from the endogeneity of the sales mode in the unit value equation I carry out a Hausman test. This test compares the OLS and IV estimates of equation (15)).

3.50. Empirical results and discussion

(a). The production function

Table 3: IV Estimates of the Coffee Production Function

ln (Quantity produced)	Coefficients	t-values
ln (Labor allocated to coffee)	0.2611 (0.1488)	1.76
ln(Area allocated to coffee production)	-0.2088 (0.1674)	-1.25
ln(Trees under production)	1.0114 (0.1713)	5.90
Farming experience (years)	0.0047 (0.0018)	2.49
ln(Tree squared)	-0.0447 (0.0157)	-2.85
ln (Trees) *ln (Area)	0.0741 (0.0349)	2.12
Constant	-0.3687 (1.018)	-0.36
R-squared	0.397	
Root MSE	0.7224	
Observations	693	
Instrumented	ln(Labor)	
Additional instrument	ln(Adults)	

Standard errors in parentheses

Coffee production is significantly more responsive to tree stock as compared to the labour input as evidenced by the large coefficient (1.01) and *t*-value (5.9) on *lnTrees*. The coefficient on the labour input is smaller: 0.26 and weakly significant at a 5% level. The coffee supply elasticity with respect to land is partially influenced by the tree stock, such that each additional acre increases coffee production as the number of trees per acre increases. This effect is explained by the incidence of coffee wilt disease which lowers coffee productivity per acre by destroying coffee trees. Depending on the severity of the disease and the replacement efforts at the household level, coffee production per acre is

heterogeneous among households in the same village. Though significant, the effect of farming experience on coffee production is not economically large.[4]

The coefficient on the tree stock *Trees* is positive while the coefficient on the quadratic term of tree stock is negative implying the presence of diminishing returns to scale in the coffee production function. This shows the likely presence of diseconomies of scale in coffee production where productivity decreases as farm size increases. Dividing the coefficient on *lnTrees* by twice the coefficient on *lnTreesSq* and multiplying the quotient by 100 gives 1123 trees (which are equivalent to about 2.5 acres of coffee area) as the maximum coffee area at which returns begin to diminish for rural households. Compared to the sample average of 1.37 acres of coffee, the majority of rural farmers still have room to profitably increase their productive potential given more land, labour, and coffee seedlings for planting.

The inverse relationship between yield and farm size is in line with the literature on rural household modelling and is attributed to the presumption that the opportunity cost of family labour working on the farm is less than the prevailing wage. Smaller farms therefore tend to use a production process that is more labour intensive and, in traditional agriculture where labour is the main variable input, obtain higher yields than larger farms that use hired labour (De Janvry and Sadoulet, 1995). This inverse relationship between farm size and productivity is relevant to land redistribution policies in that it shows evidence of efficiency gains in production that would accrue from redistributing land to landless households in addition to obvious equity gains.

[4] The estimated coefficient on the quadratic term of farming experience is negative but not significant and hence was excluded from the model

(b)The processing equation

Household wealth and the quantity of coffee produced significantly increase the probability of processing coffee while increased age of the household head decreases it. Thus, wealthy and large coffee-producing households are more likely to process and sell their coffee at the huller while older farmers are less likely to process their coffee.

Table 4: Probit Estimates of the Processing Decision

Discussion of the estimates

The coefficients on the proportion on enrolled children in the household and patience level of the household head are positive and significant at the 10% level.. This indicates that patient farmers and households with large numbers of children attending school are also more likely to process their coffee.

With large coffee quantities, unit transportation and processing costs are reduced, making it more likely for households to transport and process coffee at the hullers. Wealthy households are more likely to process their coffee since they can meet transportation and processing costs. The higher the proportion of enrolled children in a household, the higher the school fees requirements and the more likely it is that household will process coffee to generate sufficient income to pay school fees. Most of the households that processed coffee sold it towards the end of the coffee season (in January) and this period coincides with the new school term. The age of the household head has a diminishing effect on productivity: older farmers are either unable to produce sufficient quantities or lack income to meet processing and transport costs.

Specification issues: The Hausman test is not significant at the 5% level, so we fail to reject the null hypothesis that the differences between IV and LPM coefficients are not systematic. This allows us to regard the processing and production equations as recursive because there does not appear to be significant correlation between the two error terms and validates probit estimation. In effect, we may take production as exogenous in the farmer's marketing decision. Since the breush-pagan test for heteroskedasticity is significant, we re-estimate the processing equation using robust standard errors to solve the heteroskedasticity problem.

(c) Double censored Tobit estimation of the proportion of raw cherries sold

The equation is estimated using the Tobit procedure with censoring at zero and one. Table 4 shows that increased household wealth and farmer patience significantly reduce the proportion of raw coffee cherries sold by rural households. In addition, bicycle ownership

also reduces the proportion of raw cherries sold by households. Relatively wealthy patient farmers have other income sources besides coffee and are therefore able to smooth consumption against shocks without resorting to crisis sales of raw coffee. On the contrary, increases in the proportions of young and enrolled children in the household significantly increase the proportion of raw coffee sold by the household. This is consistent with the view that farmers sell coffee in raw form when they face urgent financial requirements, since these will frequently be associated with educational and child health expenditures.

Table 5. Tobit Estimates of the Proportion of Coffee Sold Raw

Rawcherries proportion	Sample selection correction excluded		Sample selection correction included		Tobit estimation with both Risk and time preference variables	
	Coefficient	*t*-value	Coefficient	*t*-value	Coeff.	t-value
ln(Wealth)	**-0.0705 (0.0263)**	-2.76	-0.078 (0.0355)	-2.22	**-.089** (0.0245)	-3.64
Patience	**-0.0462 (0.0106)**	-4.43	-0.048 (0.0119)	-4.06	**-0.05** (0.01)	-4.18
Proportion of children below 5 years in HH	**0.283 (0.14)**	2.04	0.27 (0.141)	1.94	**0.27** (0.132)	2.02
Proportional of household members enrolled in school	**0.196 (0.106)**	1.88	0.18 (0.118)	1.53	0.166 (0.1003)	1.66
Distance from markets	-0.0184 (0.0116)	-1.62	-0.018 (0.0117)	-1.59	-0.02 (0.011)	-1.77
Bicycle ownership	**-0.115 (0.0501)**	-2.23	-0.117 (0.0508)	-2.3	**-0.085** (0.044)	-1.90
Inverse mill ratio			-0.0255 (0.074)	-0.34		
Risk aversion					0.0075 (0.013)	0.56
Constant	1.16(0.391)	2.95			1.36 (0 .37)	3.69
Equation standard error	0.471					
Observations	654					
Pseudo R^2	0.055					

Anderson et al (2007) show that time preference embody both discount rates and risk preferences and therefore risk and time preferences should be jointly elicited. In the third column of table 4, I re-estimate the raw coffee sales decision including both risk and time preferences. Estimation of the equation using both risk and time preferences does not alter the main the findings given that the coefficient on the risk preferences is not significant.The *t*-test carried out on the inverse Mills ratio parameter in the equation is not significant implying that we fail to reject the hypothesis that the model does not suffer from selection bias. The inverse Mills ratios are therefore excluded from the final estimation of the Tobit model.

d) Sales location decision

Table 5 below shows three sets of probit estimates for the decision to sell to the market. These closely replicate the specification in the studies of Fafchamps and Hill (2005). Specification 1 allows for a non-linear relationship between household wealth and the probability to sell to the market but does not control for possible selection bias within sampled households. Specification 2 does not allow for a non-linear relationship between the decision to wealth and the decision to sell to the market but controls for possible sample selection bias. Both specifications 2 and 3 do not control for the effect of risk and time preferences in the decision to sell to the market. Specification 3 controls for the impact of both risk and time preferences and allows for a non-linear relationship between wealth the decision to sell to the market or at the farm gate.

Table 6. Probit Estimates for the Sales Location Decision

	(1) Sample selection correction excluded		(2) Sample selection correction included		(3) Estimation including Risk and Time preferences	
$\Pr(Market=1)$	**Coef**	**z-values**	**Coef.**	**z-values**	**Coefficient**	**z-values**
ln(Quantity)	**-1.92 (0.98)**	-1.95	1.95 (0.98)	-1.98	-2.37 (0.929)	-2.55
ln(Wealth)	**-0.64(0.32)**	-2.02	-0.72(0.32)	-2.23	-0.71 (0.302)	-2.35
ln(Quantity)*ln(Wealth)	**0.14(0.064)**	2.22			0.173 (0.061)	2.84
Bicycle	0.09 (0.15)	0.61	0.061(0.16)	0.39	0.095 (0.133)	0.71
Market distance	0.04 (0.02)	1.92	0.045(0.023)	1.97	0.045 (0.024)	1.91
Proportion of HH members enrolled	-0.81 (0.279)	-2.90	-1.003(0.31)	-3.24	-0.52 (0.261)	-1.99
Patience level					0.075 (0.028)	2.60
Risk aversion level					-0.004 (0.038)	-0.10
Inverse mills ratio			-0.31(0.21)	-1.46		
Constant	7.57 (4.78)	1.58	9.74(4.99)	1.95	8.55 (4.56)	1.87
Observations	653					
Hausman test between specifications (1) ad (2)	$\chi^2(6)$ =1.53		Tail probability **0.9576**			

Standard errors in parentheses

In the second set of estimates, the inclusion of the inverse mills ratios shows a non significant t-value on this selection term thus eliminating the possibility of selection bias in the model. I therefore re-estimate the model without the inverse mills ratios to give estimates (1). As was the case with the processing equation (see Table 3) we fail to reject the hypothesis that the difference between the LPM and IV coefficients is not systematic. The model is therefore recursive and we may condition on output.

Asignificant negative relationship between household wealth and selling to the market which is in line with Hill's (2005) proposition 4 which states that relatively wealthier farmers are less likely to sell to the market and more likely indulge in the convenience of the farm

gate sale due to the high opportunity cost of their time if invested in other income generating activities[5]

Despite quantity sold and wealth having a negative effect on selling to the market, the interaction term between wealth and quantity sold shows a significant positive effect on selling to the market. This is also in line with the proposition that wealthier farmers are more likely to sell to the market as quantity sold increases provided that unit transport costs do not increase with quantity sold (Fafchamps and Hill 2005, p.720). In contrast with Fafchamps' findings, an increase in the proportion of enrolled children in the household has a significant negative effect on the likelihood of selling to the market. This finding gives further evidence of the increased consumption risk faced by larger households. In addition , results from specification 3 show that households with more patience household heads are significantly more to sell to the market when compared to those headed by impatient household heads. In contrast to the finding of Fafchamps and Hill (2005), we find that although ownership of a bicycle has a positive effect on the likelihood of selling coffee to the market, the effect is not significant .

(e) The Unit value equation

Table 6 below shows the average unit values obtained across both sales mode and sales location among coffee-producing households

[5] I use relatively wealthy farmers because the sample has been censored to exclude processing households which are arguably the wealthiest class of coffee farmers. The coefficient on the Mills ratio which tests for selection bias resulting from censoring processing households is not significant implying that the model does not suffer from selection bias and is therefore dropped from the estimation.

Table 6: Calculated Average Unit Values and Discounts across Sales Modes and Locations

Sales mode		Unit value(Shs/kg)	Discount(p_1-p_i_)	% Discount %loss in value added
p_1	Processed coffee sold at hullers	2953	0	0
p_2	Dried coffee sold at market	1026	1927	65.3%
p_3	Dried coffee sold at farm gate	881	2072	70.2%
p_4	Raw coffee sold at the farm gate	729	2224	75.3%

On average, households that processed coffee sold for 2953 Shs per kilo while those that sold non-processed dried coffee in the market fetched 1026 shillings per kilo over the season. Households that sold dried coffee sold at the farmgate generally obtained 881 shillings per kilo while those households that sold a proportion of their coffee raw averaged 729 shilling per kilo over the season. The figures in Table 6 are calculated as sample averages irrespective of whether households are marketing through single or multiple channels.

Estimated discounts from the processed coffee price for non-processing households are reported in Table 7. In Table 7, the discounts are estimated by both OLS and IV and the Hausman test is carried out to compare the two sets of estimates. The Hausman test result is significant implying the presence of systematic differences between IV and OLS estimation due to the endogeneity of the sales mode variables. To control for the possible inconsistency due to endogeneity, the sales mode variables are then instrumented using their predicted values and other exogenous variables as instruments. In addition, the inverse mills ratios derived from the processing equation are introduced as a regressor to control for selection bias and the model estimated over all non-processing households. The coefficient on the inverse mills ratios is not significant and thus the model does not suffer selection bias.

From the OLS estimation, the differences in unit values between processed coffee and other sales modes are all significant and increase with lower processing levels and farm gate sales. Relative to processed coffee sales , farmers who resorted to raw coffee sales (δ_3) lost Shs 2554 which is about 90% of value added and revenue lost per kilo of coffee sold raw. Farmers who used dried coffee sales at the farm gate (δ_2), lost Shs 1805 (a 64% loss/kg in value addition) while selling dried coffee sales at market (δ_1) resulted in losses estimated at Shs 1696 (a 60% loss in value addition) when compared with sales of processed coffee. The IV estimates follow a similar pattern across sale modes.

The discount losses in value added in Table 6 are much smaller than those in Table 7 because in practice households usually combine sales strategies as predicted by the Kuhn-Tucker condition in equation (5) of section 2. These results show the potential increase in coffee incomes that can be obtained by improving both transport infrastructure like roads and processing infrastructure through rural electrification and investing in coffee hullers.

Table 7. IV Estimates of the Unit Value Equation

			Hausman specification test	
Discount	**OLS estimates**	**IV Estimates**	**IV estimates**	**OLS estimates**
Market x (1 - *Rawcherries*) (δ_1)	1696.(111.03)	1578(150.4)	1646.014	1696.138
(1 - *Market*) x (1 - *Rawcherries*) (δ_2)	1805(57.50)	1671(112.6)	1699.363	1805.103
Rawcherries (δ_3)	2554.(136.86)	2976.5(291.2)	2958.971	2554.111
Market distance		-26.(28.2)		
δ_2**Market distance*		32.8(32.9)		
δ_3**Market distance*		-23.8(19.6)		
Household wealth		-4.52e-06(4.39e-06)		
Inverse mills ratio		19.243(38.59)		
Observations		653		
Root mean square error		249.8		
Hausman test	$\chi^2(6) = 10.49$	Tail probability =0.0148		

Instrumented: δ_1_δ_2 δ_3

Instruments: $\delta_1$hat_$\delta_2$hat $\delta_3$hat

Standard errors in parentheses

Household wealth and market distance seem to reduce the estimated discounts but their effects are not significant.

f) Analyzing credit constraints among coffee-producing households

My aim in this section is to estimate the extent to which coffee farmers in the different sales modes are credit constrained judging from the calculated discount rates.

Table 8: Estimating Discount Rates across Sales Mode Groups

	Sales mode group			
Parameters	Processed coffee sold at huller	Dried coffee market sales	Dried coffee farmgate sales	Raw coffee farm gate sales
Average unit values V, (Shs/kg)[1]	**2953**	**1026**	**881**	**729**
Average unit production costs(Shs/Kg)[2] (maintenance & harvesting)	500	500	500	500
Average drying and bulking costs(Shs/kg)	300	200	100	50
Average transport costs(Shs/kg)	20	20	0	0
Hulling costs (Shs/Kg)	200	0	0	0
Total unit costs f, ***X*** (Shs/kg)	**1020**	**720**	**600**	**550**
Average unit profits ***(V-X)*** Shs/kg	**1933**	**306**	**281**	**179**
Average time periods taken before selling[3] coffee during the season, ***n*** (years)	0.33 (4 months)	0.08 (1 month)	0.08 (1 month)	0.06 (3 weeks)
Estimated discount rates, r (%)	**24%**	**69%**	**99%**	**132%**

Average unit values obtained from mixing sales strategies in table 6 are used here because they reflect how household sell coffee in practice.

[2] Source: IFPR (2007).Figure in paper is adjusted from 420sh to 500sh to account for inflation in 2008. Information on other costs is obtained from secondary data collected during the survey.

[3] Average time periods before sale are estimated from information on month of first sale elicited in questionnaire because in practice farmers usually make more than one sales during the season

Discount rates across the different sales modes are computed as follows;

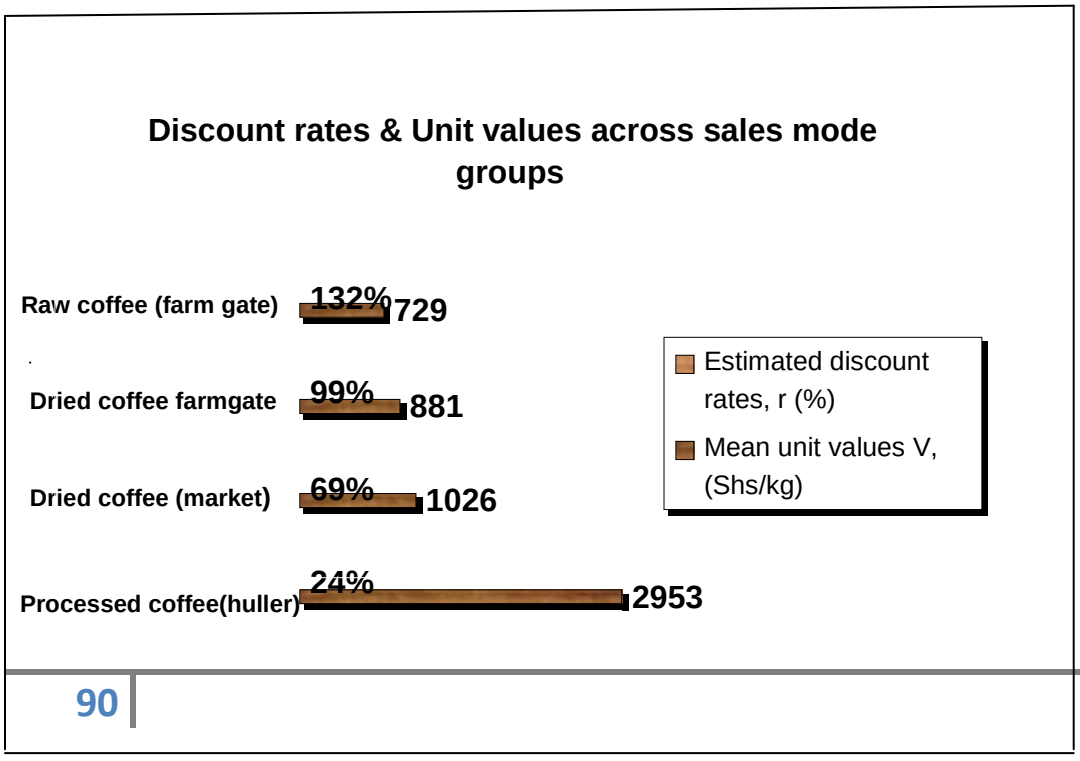
$$\rho = \left(\frac{V}{X}\right)^{\frac{1}{n}} - 1 \qquad (16)$$

where *V* are the estimated mean unit values (or unit revenues) for the sales mode groups in Shs/kg, *X* are the estimated mean unit costs for the sales mode group in Shs/kg, and *n* are the estimated mean time periods taken before selling coffee during the season in years. Table 8 shows that unit costs and the waiting time before actual sales transactions involved

in processing coffee at the hullers are higher compared with other sales modes. This is not only because of added processing costs but also but also because of the extra care involved in picking only ripe cherries in order to obtain a higher out-turn of fair average coffee (FAQ) after hulling. In addition, processing households have to bulk and dry their coffee a little longer on average in order to obtain the required moisture content at the huller which explains the higher unit drying and bulking costs.

Table 8 shows a contrasting pattern between the unit values, profits and discount rates as one move from the processing to non-processing households. Figure 3 illustrates. Despite unit values (revenues) and costs associated with processing coffee being higher, the profit margins are on average four times higher than those of the non-processing households. Surprisingly, only 6% of the 700 households surveyed sold processed their coffee and sold it to the huller. This provides strong evidence for the presence of credit constraints whose evidence is shown by the increasing discount rates as one moves from processing to non-processing households in Table 8.

Figure 4: Discount rates and Unit values across Sales Mode groups



3.60 CONCLUSIONS

This study has comprehensively analyzed the complex marketing strategies of different households in the Ugandan coffee supply chain and examined the implications for the incomes of coffee-producing households. I group the conclusions into three sections.

a) Scale of production:

Despite the significant positive effect of the increased coffee quantity on the likelihood of processing and selling coffee to the market, the average farm size and tree stock in the sample is of 1.37 acres and 267 trees respectively. These figures far below the full productive capacity of 2 acres of coffee and about 1000 trees at which returns from coffee production begin to diminish as estimated from the production function. This implies that there is still room for increasing coffee production through the provision of coffee plantlets by government to farmers. This will increase production volumes and counter the projected declines in coffee prices and other commodity markets during this recession period. In the short run, the government should encourage aggregation of production for purposes of processing coffee using farmer groups.

b) Impatience and credit constraints:

By comparison with previous studies, this study has captured a crucial but relatively under-researched aspect of the coffee supply chain: the impact of increasing heterogeneity in coffee sales mode and sales location decisions prior to and after harvesting on incomes. Most notably, the study has considered the impact of raw coffee sales on incomes. This

phenomenon has seldom been documented or discussed.[6] My results indicate that raw coffee sales appear to substitute for credit for farm households who face urgent family-(education and health) related expenditure requirements. The implied annual interest rate on this means of obtaining funds is estimated at close to 100 per cent on an annual basis.

From the analysis, we can see that the differences in coffee revenues across households are not only due the sales location decisions but also the due to the sales mode and timing of coffee sales (patience). The approach used in the study allows the calculation of the financial benefits of different household choices in the coffee marketing chain. It also highlights the benefits of increased household processing in the coffee value chain, and the effects of different sales outlets (i.e. market, farm gate or huller) on unit values and subsequent seasonal coffee incomes.

The insights gained from this study may be useful in designing and evaluating alternative policies to improve the functioning of the coffee supply chain. The findings show that there would have been substantial potential for Ugandan coffee farmers to substantially increase their revenues through better processing and marketing even if world coffee prices had remained at the low levels prevailing at the time of my survey. Farmers appear to be constrained by lack of access to credit and these forces many of them to market coffee in ways which reduce total revenue. The bottom line is that commodity policy, at least so far as it regards the Ugandan coffee sector, should be more focused on credit and productivity than on prices.

[6] The sporadic nature in which small quantities of raw coffee are sold at different times during the season makes it difficult to capture them. In this study, farmers where asked about the number of times they sold raw coffee and the quantities involved over the season. They were then asked to give an estimate of what they thought the total quantity would be, had they bulked the coffee without selling it raw to reconcile the estimates.

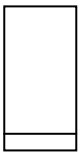
(c) Methodological contribution of this study

Compared to previous studies on coffee marketing, the methodology used study has not only incorporated behavioural economics aspects to farmer decision making but also added the entire context in the coffee marketing chain. I have drawn on the psychology and behavioural economics literature using multiple price list experimental methods to characterise the patience of farmers. The elicitation of both farmer risk attitudes and patience levels using context dependent scenarios has enriched coffee marketing literature by showing the importance of farmer patience and the underlying factors like urgent cash requirements that drive coffee marketing decisions. (see chapter 3 appendix) .Compared to Fafchamps and Hill's study, which considered only one component of the farmer's overall marketing problem in Uganda, this study has added the entire context to the overall marketing problem.

Chapter 3 Appendix 1: CAPTURING FARMER PRICE RISK AND TIME PREFERENCES

a) Eliciting farmers' time preferences (discount rates) i.e. how patient they can be.

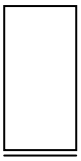
If a reputable and trustworthy organization comes to buy your coffee at 1200 shs per kilo of Kiboko but promises to give you more than that in 4month's time



i) What would you prefer? (Select only one answer)

(a) 1200shs per kilo of kiboko (unprocessed coffee) right now

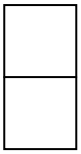
(b) 1250 Shs per kilo of kiboko in 4 month's time



ii) What would you prefer? (Select only one answer)

(c) 1200shs per kilo of kiboko right now

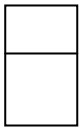
(d) 1500Shs per kilo of kiboko in 4 month's time



iii) What would you prefer? (Select only one answer)

(e) 1200shs per kilo of kiboko right now

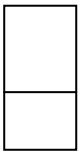
(f) 1800 Shs per kilo of kiboko in 4 month's time



iv) What would you prefer? (Select only one answer)

(g) 1200shs per kilo of kiboko right now

(h) 2200 Shs per 20kilo of kiboko in 4 month's time



v) What would you prefer? (Select only one answer)

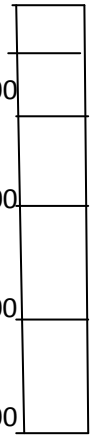
(i) 1200shs per kilo of kiboko right now

(j) 2500 Shs per kilo of kiboko in 4 month's time

***b) Eliciting farmers' price risk attitudes**

From your experiences on producing and selling coffee over a long period of time, fluctuations in coffee prices are one of the major problems in coffee production. Supposing you were contacted by five reputable companies each with the following conditions in order to sign a selling contract with them at the beginning of the season. Which one would you choose?

a)The 1st company promises to offer a constant price of shs1200 per kilo of coffee throughout the season



b)The 2nd company promises to offer a price of sh1150 per kilo with a probability of 0.5 and sh1400 with a probability of 0.5

c)The 3rd company promises to offer a price of sh1100 per kilo with a probability of 0.5 and sh1500 with a probability of 0.5

d)The 4th company promises to offer a price of sh1000 per kilo with a probability of 0.5 and sh1800 with a probability of 0.5

e)The 5th company promises to offer a price of sh 0 per kilo with a probability of 0.5 and sh2300 with a probability of 0.5

Appendix 2

The farmer has a standard utility function *u*(.) which depends on his subsistence crop consumption *a*, taken as fixed, and his consumption *c* from sales of coffee. His maximization problem should strictly be seen as recursive since raw coffee sales in one year affect disposable income in the following year. I cut through this difficulty by supposing the heuristic $c = \theta y$ applying to each crop year with the result that the farmer may be thought of as choosing a security level $\theta \leq 1$.

For simplicity, suppose that an expenditure shock can only arise at the date of possible raw coffee sales, η prior to the end of the coffee year. The farmer's cash income in the previous year was *y* so $y-(1-\eta)c=\left[1-(1-\eta)\theta\right]y$ remains at date η. He needs to choose θ at the start of that year. Again for simplicity, suppose that he does not carry any cash balance forward to the new coffee year – any remaining cash at the end of the crop year is spent on durables (house repairs etc.) which enter the utility function in the same way as other cash expenditures. An expenditure shock at η occurs with probability π and is size *s.* His expected utility over the crop year is

$$Eu=(1-\eta)\Delta_1 u(a+\theta y)+\eta\Delta_2\left\{\pi u(a)+(1-\pi)u\left(a+\left(1-(1-\eta)\theta\right)y\right)\right\}$$
$$\Delta_3\left\{\pi\left[u\left(a+\theta p_d\left(q-\frac{\left[1-(1-\eta)\theta\right]y-s}{p_4}\right)\right)\right]+(1-\pi)\left[u\left(a+\theta p_d q\right)\right]\right\} \qquad (4)$$

where the discount factors Δ_j are

$$\Delta_1=\int_0^{1-\eta}e^{-\delta t}dt$$
$$\Delta_2=\int_{1-\eta}^{1}e^{-\delta t}dt$$
$$\Delta_3=\int_1^{2}e^{-\delta t}dt$$

Maximization of expression (4) with respect to θ determines the cash balance b that will remain at the time of the possible expenditure shock.

Household Diversification, Poverty incidence and Transitions:

Analyzing the dimensions and Impact of diversification on Poverty over time: Evidence from the 1992/2000 panel of Ugandan households

1.0 Introduction

Diversification may be driven by both pull and push factors and these may have different impacts on household poverty in the long run, depending on whether push factors dominate pull factors or vice versa. Desperation led-diversification which is mainly driven by push factors such as market failures in credit, factor and output markets may perpetuate poverty as risk-averse households diversify into many low return activities to mitigate risk. On the other hand, profit-led diversification which is driven by pull factors such as urbanisation, endowments with superior technologies and strategic complementarities between household activities can be poverty-reducing over time. I use panel data to

i) determine whether there is causal link between poverty and diversification in Uganda

ii) test the hypothesis of whether household diversification reduces incomes and perpetuates poverty over time and vice versa.

I also analyze the impact of the different dimensions of diversification on the incidence, severity of poverty and transitions into and out of poverty within households over time. I find a significant positive effect of increasing the variety or portfolio of household activities on household welfare and poverty reduction. In addition to diversification, I find household size, access to education services, access to health services, age and sex of the household head to be significant determinants of household welfare and poverty over time. In

addition, there is heterogeneity in the way these factors affect poverty across the different regions of the country.

As part of the wider set of issues relating to the Rural Non-Farm Economy (RNFE), household diversification is one of the subjects that galvanize opinion when it comes to economic policy aimed at enhancing growth and reducing poverty. On one hand, neoclassical economic theory on risk characterizes poor households as risk-averse agents who sacrifice high returns for low stable incomes by diversifying into many low-return but low-risk activities. (Dercon, 2005). This, it is argued, further perpetuates poverty by comparison with households that specialize in the production of a small number of high-value commercial agricultural commodities on a large scale. On the other hand, price volatility within agricultural commodity markets has led to calls for LDCs to promote the RNFE implying a move towards non-agricultural activities. According to a 2009 UNCTAD report on the State and Development Governance (UNCTAD, 2009), LDCs, should diversify into activities which offer a dynamic comparative advantage, exploit inter-sectoral linkages between non-agricultural activities and simultaneously increase agricultural productivity if they are to reduce effects of food and financial crises.

Although household diversification is multi-dimensional concept, most studies have taken a narrow view of income diversification. Aspects of household diversification include the share of incomes households derived from non-farm sources, the number of activities undertaken by households, enterprise types and the diversification strategies (portfolio of activities) that households adopt to cope with risk and generate incomes. Results from recent studies on household diversification have been mixed, with some showing a significant positive impact of household wealth on diversification while others show no such

effect. (Barrett et al, 2001). Empirical evidence from diversification studies undertaken using Rwandan household surveys shows some gains to diversification depending on the portfolios of activities involved (Dabalen et al, 2004). It has been argued that this has generated a wedge between poor and relatively well-off households with access to profitable non-crop enterprises thus increasing income inequality among communities.

Most of the evidence in the income diversification literature is qualitative. Dabalen et al (2004) apply a matching methods approach using cross sectional data to study diversification patterns in Rwanda. However, the extent to which cross sectional surveys can explicitly determine the potential impacts of diversification on poverty reduction over time is limited. The available evidence has also been limited in terms of providing a detailed account of the changes in activity diversification patterns and has not adequately quantified the extent of poverty reduction and earnings over the different farming and non-farm activity portfolios of households over time. Smith at al (2001) study diversification patterns across two rural district in Uganda but their studies are restricted to a single view on income diversification, rather than comprehensive multi-dimensional view which takes into account the portfolio mix of activities undertaken, the number of income sources and the types of non-crop enterprises undertaken(i.e. whether primary, processing or services).

In this chapter, I address the above issues by studying diversification using a balanced panel of 1014 Ugandan households which were sampled in 1992 and then re-sampled 1999/2000. I analyze the different dimensions of household diversification including; (i) the share of incomes from non–agricultural activities, (ii) the number of activities undertaken by households and (iii) the types of activity or enterprise portfolios that households undertake.

Here, I not only study the determinants of diversification and their impacts on poverty and inequality but also take the analysis further to study non-crop enterprise dynamics, in particular the determinants of entry, survival and switching between non-crop enterprises, and the subsequent impacts on household poverty over time. I then break down the analysis by sector specifically agriculture, other primary activities, trade and manufacture, and services, to identify which sectors have the greatest impact on poverty reduction and why. I envisage that this detailed study will give some pointers to which activity portfolios generate higher returns on poverty reduction and factors that drive the composition of activity portfolios and changes in composition over time.

1.10 Working Hypotheses

The main working hypotheses to be tested in this chapter include the following

Diversification in Uganda may be either 'Push' (desperation-led) or "Pull" (profit-driven).

If household diversification in Uganda is push (desperation-led) it will perpetuate households further into poverty over time. If household diversification in Uganda is pull (profit–led), it will drive households out of poverty in the long run. Therefore ,If low incomes lead to greater diversification, poorer households are more likely to engage in numerous low return but low risk activities thus driving a gap in welfare between the poor household and the richer households that specialise into fewer high risk but profitable activities. This is also likely to increase income inequality between the rich and poor households over time.

1.11 Poverty trends and in Uganda during the 1990s

Despite Uganda's economic recovery in the 1990s being widely documented as a success story in Sub-Saharan Africa, there has been concern over whether the growth recorded in

the official statistics was reflected in the living standards of the majority of the population especially the poor (Appleton, 2001). Panel data evidence shows that, much as there was an excellent record in reducing the incidence of monetary poverty during the 1990s, there was also substantial mobility into as well as out of poverty during the same period (Okidi and McKay, 2003).

Lawson et al, (2005) exploit the complementarities between combined qualitative and quantitative analysis to unearth the underlying factors behind poverty persistence and transitions. One of their findings is that the activities people are engaged in are important drivers of poverty dynamics, with work in non-agricultural activities in rural areas forming an escape route out of poverty which, nevertheless, requires access to a sufficient level of human capital. Ownership or access to assets like land and cattle, education and demographics like household size and dependency ratios are the other important factors that they identify as major drivers of poverty transitions.

1.12 Theory on diversification and Economic growth

According to Lewis (1954, 1955), the movement of surplus labour from low-productive agriculture to high -productive non-agricultural sectors is the main driver of growth in poor economies. Lewis theorized that in poor countries where the population is large relative to capital and natural resources, the marginal product of labour in the agricultural sector will be close to zero. If this is the case, a substantial reduction in the labour input is possible at little cost on terms of agricultural output since agricultural productivity rises with this reduction in labour.

In this transition, increased productivity in the agricultural food sector is key because it increases the competitiveness of the manufacturing and service sectors on international markets through reduced wages, as food prices go down. Ranis and Fei (1961) formalized the growth process in a model that views growth as resulting from the transfer of labour from agriculture to industry with capital accumulation rising from the surplus between agricultural production and the average wage bill. Suppose workers are paid the average product of agricultural labour $w_a = ap_a > mp_a$ on the farm and the marginal product in industry $w_i = mp_i$ off farm. Workers will move into industry as long as $w_i > w_a$ and thus the average product in agriculture will set the floor to the industrial wage. The difference $mp_i - mp_a$ is the marginal agricultural surplus which is the gain to the economy from shifting labour out of agriculture. Investment of this surplus capital generates the demand for industrial labour.

However, economic transformation of Sub-Saharan African LDCs has been relatively slow with the majority of households remaining engaged in agricultural production with limited agricultural processing. Trade in agricultural and general merchandise is mainly to urban and semi-urban households while the manufacturing sector has been dominated by low-technology and low value-added products (UNCTAD, 2009).

In this chapter, I undertake a deeper analysis into the activities that households are engaged by breaking down the households according to the types of activity portfolios, the number of income sources they have, the share of income that they derive from non-agricultural activities and the changes in types of non-crop enterprises they operate in order to study the impact of household diversification patterns on poverty over time. I integrate community variables, education, and household demographics like size and dependency

ratios to determine which activity portfolios (sectors) contribute higher to poverty reduction over time. I also analyze temporal enterprise patterns in terms entry, survival and switching behaviour among non crop enterprises over time to determine the drivers of economic transformation over time and to quantify the impacts of these sectoral transitions on household welfare over time using quantitative data.

Section 2.2: Literature review on Poverty and Diversification

2.20 Definitions and measurement

According to the World Bank (2000), poverty is pronounced deprivation in well-being. Here well-being is thought of as command over commodities such that people are better off if they have greater command over resources. This is a traditional and narrow view of poverty. A much broader approach of poverty is based on the ability of households to obtain a specific type of consumption good like shelter, education or health care. The broadest view of poverty is the multi-dimensional view advocated by Sen (1987) in which he argues that well-being comes from the capability to function in society such that poverty arises from lack of key capabilities like inadequate income or education, poor health or insecurity, low self-confidence, a sense of powerlessness, absence of rights such as freedom of speech. Kuklys and Robeyns (2004) discuss measurement issues, questions of operationalization and applications with respect to the capabilities approach to measuring poverty.

Although these broader views of poverty are conceptually attractive, I restrict myself to the narrow view of command over commodities in this study where I base poverty measures on household consumption. This is because the capabilities approach is difficult to operationalize given the available household data. (Alkire, 2002). Most researchers prefer

consumption to income as a basis for deriving poverty measures because of the tendency for income to be understated and because consumption more precisely reflects the resources controlled by the household in the short term and thereby comes closer to the household's permanent income. (Fafchamps et al, 2005). At the same time, it is important to acknowledge that consumption can also be an unreliable measure of permanent income because different households have different consumption smoothing capabilities (World Bank, 2005). Consumption per adult equivalent is preferred to consumption per capita as a measure of household well-being because adult equivalence scales can in principle correct for economies scale in consumption that come with different household composition. Here, households with different numbers of children and adults are converted into adult equivalents for comparison purposes. However, the use of equivalence scales is limited by the fact assumptions about unobservables such as how the aggregate is split within the households will be required. In addition, the assumptions in computing consumption for individuals can have a significant bearing on policy choice when the economist has only information about aggregate consumption and household composition without information on how consumption is distributed within households (Deaton, 1997). For example, a household with a large number of children may have a higher consumption per adult equivalent than a comparable household with the same per capita consumption but a smaller proportion of children. The choice of definition can therefore have policy consequences.

The consumption measure adopted is compared with a poverty line, which is often taken as the market value of the bundle food items required to achieve a minimum caloric value (usually 2100 calories) per person per day. If the value consumption per adult equivalent for

a given household falls below the poverty line, then that household is considered poor and the percentage of poor households in the population gives the poverty head count measure (P_0).

$$P_0 = \frac{No\ of\ poor\ people\ in\ population}{Total\ population} \times 100 \qquad (1)$$

Other poverty measures include the poverty gap (P_1) which is the ratio of the deficit in consumption of the poor household from the consumption level of the poverty line relative to the consumption level at the constructed poverty line averaged over all households in the population.

$$P_1 = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{G_i}{z}\right) \qquad (2)$$

where $G_i = \max(z - C_i, 0)$ is the difference between the poverty line *z*, and the household's consumption per adult equivalent (AE). *N* is the total population. This measure gives the absolute amount of money that would be required to eliminate poverty from the population if all poor people in a given population are perfectly targeted. Poverty severity (P_2) is the squared value of the poverty gap measure (P_1) which attaches more weight to poor people in the population.

$$P_2 = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{G_i}{z}\right)^2 \qquad (3)$$

Measures of poverty gap and poverty severity complement the poverty incidence measure by giving more detailed information about how far off the consumption levels of poor people are from poverty line. In other words the extent to which poor people are poor . For example, communities or sectors showing a high incidence of poverty as indicated by a high

poverty headcounts may have a lower severity of poverty when most of the poor people are just below the poverty line and vice versa.

Household diversification is multi-dimensional concept which sees households as not only diversifying their incomes but also as increasing the number of income-earning sources, the range of assets they own and the types of non-farm enterprises they undertake. Diversification also entails different activity portfolios or strategies that households undertake in order to cope with risk and generate incomes to support their livelihoods. These strategies include the full time farmer strategy, the farmer-worker strategy, the farmer-non-crop enterprise strategy and the farmer-worker-non-crop enterprise strategy. (Barret, Bezuneh and Aboud, 2001). Choices over the different activity portfolios are determined by the capital, resource and skills endowments of the households. These choices have different impacts on household welfare in terms of earnings and poverty reduction over time, an aspect explored later in the chapter.

Another dimension of household diversification is the type of non-crop enterprise undertaken by the household and the changes in enterprise ownership and type over time. Here, household non-crop enterprises are categorized in five groups namely; (i) primary production, (ii) primary processing, (iii) trade (wholesale and retail) (iv) services and (v) other enterprise types. The analysis goes further to study the non-crop enterprise patterns over time to determine household entry, survival switching and exit on household welfare over time. Whether jointly or individually, the different dimensions of diversification may impact on the extent of the reduction in household earnings and poverty over time. Analyzing complementarities and substitution between the different dimensions of

household diversification can be useful in establishing the inter-sectoral linkages needed in implementing effective policies aimed at boosting the rural non-farm economy.

2.21 Economic Theory behind Poverty and Diversification.

Poverty is determined by regional, community, household and individual characteristics of household members. Regional variables which are likely to increase poverty include isolation or remoteness which entails less infrastructure and limited access to markets and services. Other relevant regional variables are land availability and quality, weather and environmental conditions, regional governance and inequality. (World Bank, 2005),

Community determinants of poverty include infrastructure (i.e. access to tarred roads, piped water and electricity), land distribution, access to public goods and services (i.e. proximity to schools and clinics) and social capital. Household variables include size, dependency ratios (i.e. unemployed young and old relative to working age adults), and gender of household head, age structure, assets, diversification and average health and education of household members. Larger households and those with many non-working dependants are more likely to be poor when compared to smaller and households with fewer dependants. Households headed by females, older, asset-poor and less-educated people are more likely to be poorer than households headed by males, younger, asset-rich and educated people respectively. (Lawson et al, 2005) Individual poverty determinants include age, education, employment status, health status and ethnicity. Since poverty is a phenomenon that affects the individuals in households but measured at household level, household weights are used to compute descriptive household characteristics like size, wealth and others.

Diversification, just like poverty, is influenced by both community and household factors some of which may be push and others pull. Push household factors include poverty itself,

climate and price risk, diminishing returns to land productivity as the population increases, credit constraints leading households into self provision of goods and service, and missing markets. Depending on whether risk-aversion dominates risk taking, the coefficient of poverty on diversification may be positive or negative. If poor households undertake numerous low return activities on and off farm in order to mitigate risk, poverty will have a positive effect on diversification. This is desperation-led diversification that limits the possibility of escaping poverty. On the other hand, if superior asset levels, technologies and skills are required to take advantage of other income generating activities off- farm, poverty is likely to have a negative effect on diversification. (Barrett et al, 2001). Fluctuations in climate and prices of agricultural goods will push households to diversify into other non-agricultural activities in order mitigate risk thus having positive effects on diversification. Diminishing returns to labour on arable land are likely to make households hire out labour into other activities off-farm thus increasing household diversification and vice versa.

Pull factors to diversification include economies of scope arising from complementarities between agricultural and non-agricultural enterprises, endowments with superior skills and technologies by households and community engines of growth such as urbanisation which generates markets for different services and goods. All these factors are likely to have a positive effect on household diversification. These factors stimulate profit-led diversification which has the potential to increase household incomes and reduces poverty over time. (Barrett et al 2001). From the model above, it may be seen that poverty and diversification are jointly determined and some independent variables which drive household poverty also influence household diversification and vice versa and that the relationship between poverty and diversification is empirical.

2.22. Data sources, Variable definitions and Methods

I use a panel of 1014 households which I filter out from the 1992 and 2000 Uganda National Household Surveys collected by the Uganda Bureau of Statistics. During 1999 survey, some households which were sampled in 1992 were re-visited. I group households into mutually exclusive activity groups and diversification strategies, using the enterprise section of the questionnaire. This 1999/2000 survey entailed a community module which asked retrospective questions about communities in 1992 forming a good basis for capturing changes within community variables in the panel. For poverty analysis I use the consumption estimates and the poverty line derived by Appleton (2001) for Ugandan data.

Table 1 that follows in the next section provides definitions of the variables captured in this study , how they are measured and the underlying concepts they capture.

Variable	Variable definition	Variable construction/Concepts captured
Poverty variables		
Poverty headcount *Po*	The percentage of poor households in the population	$P_0 = \frac{No\ of\ poor people in\ population}{Total\ population} \times 100$
Poverty gap *P1*	Average of the ratio of the shortfall in consumption of households from the consumption level of the poverty line relative to the consumption level at the poverty line	$P_1 = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{G_i}{z}\right)$
Poverty severity P2	The squared value of the poverty gap measure (P_1) which attaches more weight to poor people in the population	$P_2 = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{G_i}{z}\right)^2$
Log of Consumption per adult equivalent	Natural log of the ratio of the monthly household consumption aggregate to the number of adult equivalents in the household	$Log\left(\frac{Monthly\ household\ consumption}{No.of\ Adult\ Equivalents\ in\ Household}\right)$
Household diversification variables		
Share of non-agricultural income, S_i	Non-agricultural income also includes all income from non-primary farm activities like processing & marketing agricultural produce	$S_i = \frac{Total\ household\ non-agricultural\ income}{Total\ household\ income}$
Number of incomes sources , N_i	Total number of on and off- farm income earning activities undertaken jointly or individually by household members	Variable captures the quantitative dimension of household diversification
Diversification portfolio D_i Farming only household Farming -wage household Farming-enterprise household Farming-wage-Enterprise household	The portfolio mix or combination of activity groups from which households derive livelihoods . Activity groups include i.e. farming, wage labour and non-farm enterprises ,	Variable captures the qualitative dimension of household diversification (economies of scope from diversification)
Community variables		
Log transport costs	Natural log of transport costs from the capital city(i.e. Kampala) to the community/village in which household is located	Variable captures access costs and remoteness of households
Agricultural constraint Dummies *Markets* *Roads*	Dummy variables which capture the main constraints to households' agricultural production with the community *lack of output markets* *poor roads*	Variable captures push factors underlying household diversification

Variable	Variable definition	Variable construction/Concepts captured
Diseases	*Crop diseases*	
Security *Land* *Credit* *soil*	*security* *land limitations* *lack of access to* *credit* *Poor soil fertility*	
Schools	Refers to the availability of primary schools in community *Values; 1 if school is within the community, 2 if school is 3km* *outside community and 3 if school is over 3km outside village*	The variable captures the effect of access to education on diversification and poverty
Hospitals	Refers to the availability of a health center in the community *Values; 1 if health centre is within the community, 2 if it is 3km* *outside community and 3 if it is over 3km outside village*	The variable captures the effect of access to health services on diversification and poverty
Proportion of households buying food during the lean period	*This is an estimated percentage of households buying food in lean period obtained from the community questionnaire*	The variable captures how changes in food security within communities affect poverty & diversification
Household variables		
Sex	Is the sex of the household head	
Age	is the age of the household head	
Log per capital household wealth	Is the natural log of ratio of total value of of all household assets (adjusted for depreciation) to household size	$Log\left(\frac{Depreciation\ adjusted\ \ value\ of\ household\ assets}{household\ size}\right)$
Household dependency ratio	Is the ratio of working adults to non-working young and old people in the household	Variable captures the how the burden on workers in households affects consumption

2.33 Descriptive statistics

Table 2 shows the weighted means and frequencies of the major variables of the study. The means are weighted in order to account for household poverty analysis given that poverty affects individuals in households. Generating household weighted descriptive statistics also helps to control for biases that might have arisen from the stratified sampling methods which are usually used for data collection during national household surveys.

Household size increased from an average of four persons per household to six persons per household between 1992 and 2000 reflecting a substantial increase in population. A breakdown of the household size distribution shows a relatively higher increase in household size for both rural and poor households when compared to urban and non-poor households. Mean household assets (wealth) increased by about 25% over the eight year study period for the total sample, a result which is in line with Uganda's impressive economic recovery during the 1990s. However, growth in asset wealth was unequally distributed with urban and rural households growing 41% and 19% richer in assets respectively. Household dependency ratios declined by 34% in the panel as more adults got work to support non-working household members over the 8-year period.

Table 2: Descriptive Statistics from the 1992/2000 sample of 1014 households										
Household variables	**Total sample**		**Rural**		**Urban**		**Poor**		**Non-poor**	
Year	1992	99/00	1992	99/00	1992	99/00	1992	99/00	1992	99/00
Household variables										
Household size	4	6	4	6	4	6	5	6	4	5
Asset value	264	329	231	274	206	291	265	294	219	298
% change in assets	24%		19%		41%		11%		36%	
Education	6.6	6.9	6.3	6.7	6.9	7.6	6.3	6.8	6.5	6.2
Dependency ratio	2.66	2.40	2.75	2.27	2.96	2.12	3.08	2.53	2.41	2.20
	-10%		-18%		-28%		-18%		-9%	
Welfare measures[7]										
Mean monthly	27.5	41.95	22.03	35.2	37.4	66.01	15.6	20.2	37.6	50.0
Mean monthly consumption per	8.557	11.4	6.7	9.3	11.9	19	3.9	4.3	12.5	14.01
% change in mean	52.5%		38.8%		59.7%		10.3%		12.8%	
Poverty Headcount (Po)	45.7%	27%	44.9%	31.3%	30.4%	11.2%				
%Change in Poverty headcount	-41%		-30%		-63%					
Poverty depth	0.16	0.07	0.2	0.09	0.09	0.03	0.35	0.3	N/A	N/A
% change in poverty depth	-14.3		-55%		-66.7%		-14.3%			
Poverty Severity	0.08	0.03	0.1	0.02	0.04	0.03	0.17	0.1	N/A	N/A
Diversification variables										
No. of income sources	2.00	2.81	1.80	2.93	1.76	3.06	2.12	2.87	2	3
Share of agricultural income	0.30	0.52	0.18	0.49	0.16	0.50	0.31	0.49	0.26	0.50
Share of non-agricultural income	0.70	0.48	0.82	0.51	0.84	0.50	0.69	0.51	0.74	0.50
Community variables										
Agricultural wages	640	1056	696	1141	784	1291	545	949	616	978
Non-agricultural wages	796	1015	859	1266	1013	1505	693	948	807	970
% farmers buy staples(LP)	16	47	17	48	15	45	15	47	17	47

[7] Descriptive statistics for all welfare measures are for the total samples of household survey in 1992 and 1999. Other measures are for the panel sample only

Table 3: welfare comparisons between rural and urban areas

	1992	1999	%change
Mean Consumption per AE			
Rural non-poor	10289	11523	13%
Rural poor	3757	4257	39%
Urban non-poor	14984	20830	8%
Urban poor	4417	4776	8%
Mean Poverty depth			
Rural non-poor	0	0	
Rural poor	0.36	0.28	-24%
Urban non-poor	0	0	
Urban poor	0.30	0.24	-19%
Mean Poverty severity			
Rural non-poor	0	0	
Rural poor	0.18	0.11	-36%
Urban non-poor	0	0	
Urban poor	0.13	0.09	-32%

Total sample decreases of 41% and 14.3% in poverty incidence and poverty depth respectively, imply that poor households not only became less in Uganda between 1992 and 1999, but also the poor became are less poor . Poverty in Uganda is more prevalent in rural areas than in urban areas. This is manifested by higher rural poverty headcounts of 45% and 31% in 1992 and 1999 respectively compared to lower urban poverty headcounts of 30.4 and 11.2% in 1992 and 1999 respectively. Though poverty incidence declined by 41% between the two periods studied, this decline was not uniform. With a percentage decline of 63%, urban areas experienced a higher decline in the proportion of poor people when compared to rural areas was higher in urban areas. Monthly consumption per adult equivalent in Uganda increased by over 50% but the increase was still disproportionate with urban areas having a higher increase. Despite these differences between urban and rural

areas, the increase in consumption per adult equivalent of 10.3 and 12.8 between poor and non-poor households is comparable. (See appendix 1: table 13)

Looking at the poor segments of the population in Tables 2 and 3, there was a 14.3% decrease in the total poverty gap among poor people in Uganda but the rural poor had a higher decline of 24% when compared to the urban poor whose poverty gap declined by 19% between 1992 and 1999. In addition, the increase in mean consumption per adult equivalent was higher among the rural poor (i.e. 39%) than the meagre 8% increase in urban areas (see Table 3). Therefore, despite the higher poverty prevalence in rural areas, the poor in rural areas seem to be better off than the poor in urban areas. This result is in agreement with previous findings of the impressive Ugandan economic recovery coupled with inequality among regions and sectors in the economy (Denninger and Okidi, 2002).

The diversification variables show increases with the average number of income sources rising from two to three per household and an increase in the share of agricultural income. Despite the increase in the number of income sources at household level, the share of non-agricultural income declined by about 30% indicating the possibility of reduced incomes as risk –averse households invest in may low return activities for the purpose of income stability. Both agricultural and non-agricultural wages increased over the study period while food security was a concern with over 20% increase in the number of households buying food during the lean period.

2.34 Earnings across Activity, Portfolio and Diversification Groups

Table 4 shows both earnings and shares of non-agricultural income (diversification) across the activity and diversification groups of Ugandan households. Households that engaged in

the service, trade and manufacturing sectors as a main source of income had relatively higher increases in per capita earnings than those engaged in low value-added agricultural and non-agricultural activities. They were also more diversified with over 70% of their income derived from non-agricultural activities. Looking at the diversification groups, highly specialized non-farming households and highly diversified household groups (engaged in farming, enterprises and labour markets) had the higher absolute earnings and changes in earning over time when compared to moderately diversified farming households that owned an enterprise or were partly involved in the labour market. With the exception of the highly specialized non-farming households, the more extensive the portfolio of activities in which the household was engaged, the higher the share of income it derived from non-agricultural activities. This observation does not necessarily hold for the number of household income sources suggesting that success with diversification may be mainly derived from the portfolio or enterprise type undertaken rather than the number of activities. On the other hand, per capita earnings declined as the number of income activities undertaken by the household increased with the highest increase of 66% recorded at two income activities. Given that increasing activity portfolios and number of income activities give different results in terms of per capita earnings, the types of non-crop enterprises that households undertake could shed more light on the differences. Formal sector households (i.e. those that did not own any non-crop enterprise), and households engaged in primary processing enterprises had the highest increases in per capita earnings while households engaged in both the primary and wage enterprises had negative growth in per capita earnings over the 8-year period.

Table 4: Earnings across Activity, Portfolio and Diversification Groups

	Earnings per capita			**Share non-agricultural income%**
	1992	2000	%change	2000
a) Main Industry group				
other	14542	21954	51%	60
Agriculture	10660	11114	4%	42
Non-agricultural primary work	3827	3693	-4%	49
Trade & manufactures	12662	19594	55%	73
Services	10642	20898	96%	80
b) Diversification group				
Farming-only household		10365		33
Non-farming household	7373	18377	149%	100
Farming-enterprise household	10019	19000	90%	52
Farming-wage household	10544	13335	26%	58
Farm-enterprise-wage hh		15507		71
c) No. of Income activities				
1	5939	6407	8%	51
2	9682	16080	66%	49
3	11518	13863	20%	48
4	10256	13755	34%	57
5	12206	13528	11%	49
6		1366		36
d) Non-crop enterprise type				
None	8652	15757	82%	51
Primary production	8229	7165	-13%	47
Primary processing	5414	10717	98%	53
Trade	9597	11643	21%	48
Services	23131	18533	-20%	53

2.35 Poverty Incidence and Severity across Activity and Diversification Groups

In Table 5 (on pae 120), I examine the performance of different activity and portfolio groups with respect to poor households, i.e. those whose consumption falls below the poverty line. I combine the headcount, incidence and severity poverty measures like in order to get a deeper picture of not only which diversification groups show higher poverty incidence but also how poor they are in terms of their consumption gaps (shortfall) from the poverty line. By 2000, households dependent on agriculture and wage employment had relatively high poverty headcounts of over 34% while households engaged in other primary non-agricultural activities had the lowest headcount at 10%.

Poverty incidence within services wage-dependant households rose from 26.2% to 34.4% which represents a 32% increase in the number of households living below poverty line over the 8-year period. On the other hand, self employed non-agricultural households (undertaking other primary activities) saw a 50% decline in poverty prevalence from 20% to 10%. While agriculture, trade and manufacture showed only slight increases in poverty incidence. In addition, there was a larger decline in poverty gap for self-employed households (i.e. from 6.2% to 2.7%) implying that these households not only moved out of poverty but also had improvements in welfare (in terms of consumption) for those households that remained below the poverty line.

In contrast with self employed households, the poverty gap (i.e. the ratio of shortfall in consumption relative to the poverty line) increased for households dependent on employment wages which represents a further deterioration in the poverty situation for workers. Despite the agricultural sector showing the highest poverty headcount, both the poverty gap and poverty severity in this sector decreased over the 8-year period implying improved welfare for the poor in the agricultural sector. This observation has implications for poverty policy for the often forgotten working poor in urban and semi-urban areas who can be neglected in analysis of this sort and who may be worse-off than the poor in the agricultural sector. According to Warren (1995) the numbers of urban people in poverty are likely to be growing at a faster rate and in certain parts of the world, poor urban people are already greater in absolute terms than the numbers of poor rural people .

Table 5: Poverty Incidence, Severity and Transitions Across Diversification Groups									
Poverty Measure	**Poverty headcount P_0**		**Average Poverty gap, P_1(%)**		**Average Poverty Severity P_2**		**Changes**		
	1992	2000	1992	2000	199	200	P_0	P_1	P_2
	%	%Poor	%	%	%	%			
a) Main Industry group									
Formal sector	31.8	32.7	11.0	8.0	4.8	3.0	0.87	-2.9	-1.7
Agriculture	32.5	34.9	9.7	9.2	3.9	3.5	2.35	-0.5	-0.4
Other primary	20.0	10.0	6.2	2.7	2.4	0.8	-10.00	-3.4	-1.6
Trade & manufacture	30.8	31.3	9.0	6.9	3.9	2.3	0.53	-2.1	-1.5
Services	26.2	34.4	8.1	9.6	3.6	3.6	8.29	1.5	-0.1
b) ***Diversification group***									
Farming only household		32.2		9.0		3.6			
Non farming household	25.2	31.4	7.7	7.6	3.4	2.5	6.18	-0.1	-0.9
Farming-Enterprise household	32.6	35.6	10.0	8.7	4.1	3.1	3.04	-1.3	-1.1
Farming wage household	43.8	36.7	12.8	9.5	5.5	3.6	-7.08	-3.3	-1.9
Farm-Enterprise Wage household		37.3		8.8		3.4			
No. of Income activities									
1	26.6	22.7	8.2	6.1	3.4	2.5	-3.88	-2.0	-1.0
2	31.0	36.7	8.8	10.0	3.5	3.9	5.70	1.2	0.5
3	31.5	34.5	10.5	8.9	4.8	3.3	3.02	-1.5	-1.5
4	39.0	32.1	12.7	7.8	5.7	2.9	-6.84	-4.9	-2.8
5	33.3	37.1	1.5	9.2	0.1	3.5	3.81	7.7	3.4
6		0.0		0.0		0.0	0.00	0.0	0.0
d) Non-Crop Enterprise type									
None	39.5	35.6	12.5	9.3	5.4	3.5	-3.95	-3.2	-1.9
Primary production	21.7	37.4	7.5	8.2	3.6	2.6	15.66	0.7	-1.0
Processing	26.0	39.8	8.8	11.3	3.9	4.3	13.80	2.5	0.4
Trade	19.8	29.1	5.0	8.6	1.8	3.7	9.29	3.6	1.9
Service industry	13.3	26.9	3.1	6.0	0.9	2.2	13.56	2.9	1.3
e) Enterprise status									
Non entry		32.7		8.5		3.2			
Entered		31.7		8.4		3.1			
Exited		38.5		10.1		3.8			
Survived continued business		33.3		8.5		3.3			

Looking at the diversification portfolios, the poverty headcount averages increased as poor households increased their portfolio of activities, a finding which seems to support the economic risk theory on perpetuation of poverty as risk adverse poor households engage in many low-return activities for precautionary purposes. Despite the fact that absolute poverty incidence, in terms of the headcount measure, increases with larger household activity portfolios, the gains in poverty gaps and severity tend to increase as households diversify into larger activity portfolios over time. Therefore more diversified portfolios appear to be associated with improved the welfare of poor people in terms of increased consumption.

The impact of the number of income activities on long term poverty reduction in terms of incidence, depth and severity seems to favour highly specialized poor households with a single income source and highly diversified poor households with about four or more income activities. Moderately diversified households (with two or three income activities) and very highly diversified households (with four or more income activities) experienced an increase in the incidence, depth and severity of poverty over the eight- year period.

With respect to type of household enterprise (sector), the incidence of poverty, in terms the proportion of households living below the poverty line, was relatively higher in agriculture and primary processing sectors when compared with the trade and service sectors. This is due to the relatively higher value added in the service and trade sector compared to agriculture and other primary activities. Despite having a lower incidence of poverty in the trade and service sectors, poverty depth and severity increased in these sectors while primary activities saw a decline in poverty depth and severity over time. This suggests that the poor in the service and trade sectors may be poorer than the poor in agriculture, a

finding that is in line with increasing levels of urban poverty among workers and petty traders in urban and semi-urban areas. Thus a comprehensive poverty policy should not only aim at the rural poor but also the urban poor who are usually victims of rural-urban migration.

In part (e), I explore the impact of household enterprise transitions (with respect to entry, exit and survival) on poverty. As expected, households that exited from working on non-crop enterprises had the highest poverty incidence, depth and severity. Non-entrants and new entrants into non-crop enterprises had comparable poverty measures to households that continued with a non-crop enterprise over the eight-year study period.

2.36 Analyzing the impact of diversification on household poverty dynamics over time

Table 6 below shows the impact of diversification on poverty dynamics over time. A sectoral decomposition of the poverty dynamics in part (a) of the table shows that agriculture, which is the dominant sector in Uganda, had a consistently higher percentage of households that were chronically poor, fell into poverty, escaped poverty and non-poor over the period studies. Compared with the informal trade and manufacturing sector, (where the majority of households are self employed), the service sector (containing the majority of employed worker households) had a lower proportion of chronically poor households (4% compared with 9%) in the informal trade sector (see Table 11). However, a higher proportion of households in the service sector fell into poverty over the eight year period, when compared with the informal trade sector. In addition, informal trade and manufactures presented the better chance of escaping poverty at 9% when compared to wage employment at 6%.

Decomposition by activity portfolios in part (b) of the table shows that households that depended solely on farming had consistently a higher proportion of the chronically poor, of households who fell into poverty, escaped from poverty and non-poor households when compared to other activity portfolio groups over the eight-year period. This finding indicates that farm households are not a homogenous group. They consist of land- and capital-endowed non-poor households that make a decent living from agriculture, and also landless households that depend on subsistence agriculture for survival. The relatively high level of movements both into and out of poverty underlines the importance of poverty dynamics for poverty eradication policies. Poverty measures such as headcounts and poverty gaps under-emphasize the impact of poverty because they can miss out on the transitions that some households make both into and out of poverty over time.

Table 6: Poverty Transitions by Activity and Diversification Groups over Time

	Poverty transitions between 1992 and 2000			
Activity group	**%Chronic**	**%Fell into**	**%Escaped**	**%Non poor**
a) Main Industry group	**poor**	**Poverty**	**poverty**	
Other	17	13	13	16
Agriculture	70	71	71	67
Primary non-agricultural activities	0	0	2	1
Trade & manufactures	9	5	9	6
Services	4	11	6	10
b) Diversification group[8]				
Farming households	44	41	46	46
Non-farming households	3	9	11	8
Farm-enterprise households	29	24	22	25
Farm-wage households	18	20	15	18
Farm-enterprise-wage households	6	5	7	4
c) No. of Income activities				
1	6	4	9	7
2	34	32	32	27
3	38	46	42	43
4	16	16	13	19
5	7	3	4	3
6	0	0	0	0
d) Non-crop enterprise type				
None	52	51	45	49
Primary production	17	12	15	10
Primary processing	10	12	12	7
Trade (wholesale & retail)	10	17	19	19
Service Industry	11	9	10	15
e) Entry status				
Non entry	37.08	18.75	28.84	23.13
Entered	30.34	19.53	33.49	20.7
Exited	14.61	32.03	15.81	25.99
Survived	17.98	29.69	21.86	30.18

The percentage of households that were chronically poor and those that fell into poverty is lower for households with more diversified activity portfolios, moving from sole farming to

[8] Farming-only households that depend solely on agriculture for their incomes, Farming-enterprise households that combine farming and non-crop enterprises as a source of their livelihoods, Farming–wage household whose members part-time in both agriculture and wage employment on and off farm and farming-wage-enterprise that combine all the three activity portfolios for their livelihoods.

enterprises and wage incomes. Despite its positive effect on chronic poverty and poverty escapes, increased portfolio diversification was associated with a reduction in poverty escapes and a reduction in the proportion of non-poor households over time, both of which are negative effects. Households with moderate diversification, say two to three income sources, had relatively higher chronic poverty and falls into poverty when compared with highly diversified and highly specialized households. Despite this, moderately diversified households showed relatively higher poverty-escape and non-poor frequencies over time when compared to highly specialized and highly diversified household. This may indicate that moderate diversification delivers more of a safety net when compared to specialization and high diversification.

Despite the trade sector having a higher proportion of households falling into poverty in 2000 relative 1992, it had more households moving out of chronic poverty , escaping poverty and remaining non-poor when compared to the primary processing and the services sector(see part d of table 11). In part (e) of the table, households that did not undertake a non-crop enterprise over the study period had the highest proportion of being chronically poor while households that exited a non-crop enterprise sector had the highest proportion of those falling into poverty. Poverty escape rates were highest for new entrants into the non-crop enterprise sector while the proportion of non-poor households was highest among those that continually operated a non-crop enterprise over the study period, an indication of importance of enterprise diversification.

Section 3.0: Econometric estimation and discussion

Section 3.0 is divided into three 3 subsections. In subsection 3.1 , I determinethe conditional and unconditional correlation between poverty and diversification and also test for the presence of a causal link between diversification and poverty in Uganda. In subsection 3.2, I analyse the determinants of household poverty and test the Push diversification hypothesis in Uganda. In subsection 3.3, I analyse the determinants of household diversification Uganda and test the Pull diversification hypothesis.

3.11 Examining the link between Poverty and diversification in Uganda.

The "Push hypothesis'' implies that consumption negatively affects diversification but does not necessarily imply any link from diversification to poverty. The "Pull hypothesis'' implies that diversification positively affects consumption but does not necessarily imply any link from consumption to diversification. The two hypotheses therefore imply reversal of the causal direction between consumption and diversification. In order to examine the link between poverty and diversification, I examine both the unconditional and conditional correlations between diversification and poverty.

Evaluating the unconditional correlation between Poverty (proxied by consumption) and diversification

a) I evaluate the unconditional correlation between (demeaned) consumption and diversification in order to get a sense of which diversification hypothesis is favoured in Uganda's case. If the correlation positive, this favours the pull hypothesis; if the correlation is negative, then push hypothesis is favoured. Results are shown below

Table 7(a) Correlation between demeaned Consumption and the Share of household non-agricultural income

	Demeaned consumption	Share of non-agricultural income
Demeaned consumption	1.000	
Share of non-agricultural income	-0.0152	1.000

Table 7(b) Correlation between de-meaned log of Consumption and number of income sources

	De-meaned consumption	Number of hh. of income sources
De-meaned consumption	1.000	
Number of hh income sources	-0.0404	1.000

a) Table 8 Correlation between de-meaned Consumption and the Household Non-agricultural income(Shs)

	De-meaned consumption	Household non-agricultural income in Uganda Shs
De-meaned consumption	1.000	
Household non-agricultural income	-0.0022	1.000

Observation: In all the above cases, the unconditional correlation between de-meaned consumption and diversification is negative and thus favours the push hypothesis.

3.12 Evaluating the conditional correlation between the Poverty and Diversification reduced form residuals.

In order to evaluate the conditional correlation between poverty and diverisification, I determine the correlation between the error terms (residuals) in the diversification and

poverty equations. Here I estimate the reduced form equations of both poverty and diversification (including all exogenous variables) using the fixed effects OLS estimation. I then evaluate the correlation between the residuals generated from poverty and diversification reduced form equations. Results are shown below

	Poverty/consumption	Diversification residuals
Poverty residuals	1.000	
Diversification residuals	0.33	1.000

Observation: The conditional correlation between the poverty and diversification reduced form residual is positive , an indications that greater diversification may be associated with higher consumption, hence favouring the pull diversification hypothesis. However, this result is not a hypothesis test but only an indication of the dominant diversification type. More conclusive hypothesis tests will carried out later in this chapter.

In order to examine the link between poverty and diversification, I estimate the push diversification equation including consumption as a regressor and exclude the production exogenous variables. I then test the unrestricted equation against the reduced form equation using a standard *F* test.

I then estimate the pull consumption equation including diversification as a regressor and exclude the consumption exogenous variables. I also test this unrestricted equation against the reduced form equation using a standard *F* test. If one of the results from the two standard F-tests above accepts the null hypothesis while the other rejects it, it shows the existence of a causal link between diversification and poverty and, vice versa. Hypothesis test results are shown below.(Actual estimates in are in appendix ---of this chapter)

(i) Testing exclusion restrictions on the "Push'' diversification equation using the F-test

$$H_0 : \beta_{Credit} = 0, \beta_{Soil\ fertility} = 0, \beta_{Output\ mkts} = 0, \beta_{Input\ Mkts} = 0, and\ \beta_{Land\ access} = 0$$

(i.e. production variables do not affect consumption decisions)

$$H_1 : H_0 is\ not\ true$$

F-Standard test $$F \equiv \frac{(RSS_r - RSS_{ur})/q}{RSS_{ur}/(n-k-1)} \equiv \frac{(132.42-130.85)/5}{130.85/15} \equiv 0.0359$$

Where RSS_r and RSS_{ur} are the residual sums of squares of the restricted model and unrestricted models respectively, q is the number of exclusion restrictions imposed on the model, and $n-k-1$ is the denominator degrees of freedom.

With 15 and 1851 as numerator and denominator degrees of freedom respectively, the 5% significance level the F-critical value, c is 1.67

Therefore, $F < c$, meaning that we fail to reject H_0. Production variables do not affect diversification

ii) Testing exclusion restrictions in the "Pull'' Consumption equation using the F-test

$$H_0 : \beta_{HHsize} = 0, \beta_{Depend\ ratio} = 0, \beta_{Pbuy\ food} = 0, and\ \beta_{HHliteracy} = 0,$$

(i.e. Consumption variables do not affect production decisions)

$$H_1 : H_0 is\ not\ true$$

$$F \equiv \frac{(RSS_r - RSS_{ur})/q}{RSS_{ur}/(n-k-1)}$$

$$\equiv \frac{(403.89 - 379.07)/4}{379.07/15} \equiv 0.2455$$

With 15 and 1851 as numerator and denominator degrees of freedom respectively, the 5% significance level the F-critical value c, is 1.67 . The F-statistic is 0.2455.

Therefore $F < c$, meaning that we fail to reject H_0. Consumption variables do not affect production decisions.

Conclusion: Given that F-test in both the push diversification and the pull consumption equations fail to reject the null hypothesis. There appears to be no causal link between diversification and consumption (poverty).

3.2 ANALYSING THE DETERMINANTS OF HOUSEHOLD POVERTY AND TESTING THE PULL DIVERSIFICATION HYPOTHESIS IN UGANDA

3.21 Economic Model used to test the working hypotheses

Testing the Pull diversification hypothesis i.e. that diversification positively affects consumption

The "Pull hypothesis'' implies that consumption positively affects diversification but does not necessarily imply any link from diversification to poverty.

The consumption equation is the crucial equation in this model since consumption, *y* is the measure used to derive household poverty. The consumption equation is written as

$$y_{hi} = \beta' x_{hi} + \gamma' z_h + \eta_h + \tau_i + u_{hi} \quad (h = 1,\ldots,H; i = 1,2) \tag{5}$$

Here, x_{hi} is the complete list of time-varying household and community variables, z_h is the vector of time invariant variables with the intercept as the initial column, η_h is a household effect with $\eta_1 = 0$ and τ_i is a year effect with $\tau_1 = 0$. The Fixed Effects (FE) version of the model estimates

$$\Delta y_h = \alpha + \beta' \Delta x_h + v_h \quad (h = 1, \ldots, H) \tag{6}$$

where $\alpha = \Delta\tau = \tau_2$ and $v_h = u_{h2} - u_{h1}$.

Given the difficulty in testing the diversification -poverty hypothesis using equations (1) and (2), one strategy is to include the diversification variables w_h in the consumption equation such that greater diversification associated with a higher value of w_h. However, this has to be done in a way that recognizes that the lagged diversification variable cannot be treated as predetermined. The reason it may be invalid to condition on the lagged diversification variable is unobserved heterogeneity due to omitted and unmeasured variables, whose 1992 and 2000 values are correlated and which influence both consumption and diversification. If this is the case, the error terms in the estimated consumption and diversification equations will be correlated with the lagged regressors making the estimates inconsistent.

I consider a levels consumption equation estimated just for period 2 and using the period 1 diversification variables:

$$y_{h2} = \beta' x_{h2} + \gamma' z_h + \delta' w_{h1} + \varepsilon_h \quad (h = 1, \ldots, H) \tag{7}$$

The hypothesis of opportunity-led diversification is tested by $H_0 : \delta = 0$ against $H_1 : \delta > 0$. The hypothesis of desperation-led diversification is tested by $H_0 : \delta = 0$ against $H_1 : \delta < 0$ Equation (3) can be consistently estimated if $E(\eta_h \varepsilon_h) = 0$.

Diversification and poverty are jointly determined, i.e. each variable potentially influences the other. Because of joint determination, I propose to exploit the panel structure of the

data to investigate the working hypotheses. Equations (4) and (5) below are the estimated consumption and diversification equations respectively

$$LogConspAE_{i\,t} = \beta_0 + \beta_1 S_{it-1} + \beta_2 Schools_{it} + \beta_3 region_i + \beta_4 hhsize_{it} + \beta_5 sex_i + \beta_6 Elec_i + \beta_7 hospital_i + \beta_8 depend\_ratio_{it} + \beta_9 agwages_{it} + \beta_{10} age_i + a_{i1} + \varepsilon_{it1} \quad (4)$$

$$S_{it} = \beta_0 + \beta_1 LogConspAE_{it-1} + \beta_2 region_i + \beta_3 prod\_consts_{it} + \beta_4 area_i + \beta_5 elect_{it} + + \beta_6 sex + \beta_7 age + \beta_{10} Educ_i + \beta_{11} labland_{it} + \beta_{12} NFwages_{it} + a_{i2} + \varepsilon_{it2} \quad (5)$$

Where $LogConspAE_{it}$ is the natural log of the consumption per adult equivalent, $LogConspAE_{it-1}$ is the consumption lagged variable of 1992, $prod\_consts_{it}$ refers to the major agricultural production constraints within the community. These include lack of output markets, lack of input markets, lack of roads, lack of security, poor soil fertility, lack of access to arable land and lack of access to credit. $hhsize_{it}$ refers to household size, $school_i$ refers to the availability of a primary school within the community, $hospital_i$ refers to the availability of a health centre in the community, sex_i is the sex of the household head, age_i is the age of the household head, $depend\_ratio_{it}$ is the ratio of working adults to non-working people in the household representing the impact of workers' burden on consumption, $Pbuyfood$ is the estimated proportion of households buying food in the lean period within the community(captures food security effects on consumption) while $pcland_{it}$ is the per capita acres of land owned by household. S_{it} is the share of non-agricultural income for the household which is a proxy for diversification. S_{it-1} is the lagged share of non-agricultural income in 1992.Other dimensions of diversification include the number of incomes sources N_i, and the livelihood /activity portfolio of the household D_i.

3.22 Controlling for the possibility of unobserved heterogeneity in the consumption estimation

In order to control for possible inconsistency of estimates due unobserved heterogeneity in the 2000 consumption equation, I instrument the lagged diversification variable with the lagged regressors that are highly correlated with lagged diversification variable but not correlated with the error term. These include non-farm wages, labour-land ratios and the number of household incomes sources in 1992.(see chapter 5)

Choice of instruments: In chapter 5, I find that non-farm wages in 1992 have a significant negative effect on household diversification in 1992 while labour-land ratios in 1992 have a significant positive effect on 1992 diversification. Similarly, the number of household incomes sources in 1992 affects the share of non-agricultural incomes in 1992. However, these variables are not correlated with other independent variables that affect consumption in the year 2000. An increase in non-farm wages in the year 1992 significantly reduces the share of non-agricultural incomes in 1992 but may not affect consumption in 2000. Unlike covariates shocks like drought which may lead to households liquidating productive assets like land and affecting consumption in the long run, , changes non-farm wages, number of income sources and labour-land ratios in the highly heterogenous and informal non-agricultural sector may not persist beyond the years in which they occur. They are therefore not correlated with future consumption or other variables that affect future consumption.

3.23 Testing the validity of instruments used in the consumption equation

In order to check the validity of the instruments used, I test for over-identifying restrictions in the instrumental variables regression. Here, I estimate the period 2 consumption structural equation using 2SLS and generate residuals , $\bar{u}$. I then regress the residuals on all exogenous variables and obtain the R-squared, R_1^2. Under the null hypothesis that all the instrumental variables are uncorrelated with the error term ε, $nR_1^2 \approx X_q^2$. Here q is the number of instrumental variables from outside the model minus the total number of endogenous explanatory variables. If nR_1^2 exceeds the 5% critical value in the chi square distribution, we reject the null hypothesis H_0, and conclude that at least some of the instrumental variables are not exogenous.

Table 9 below shows the OLS, IV-2SLS, LPM, instrumented LPM and Probit estimates of the levels consumption equation used to test the pull diversification hypothesis. This equation is used to determine the effect of 1992 diversification (household share of non-agricultural income) on 1999/2000 welfare in terms of consumption per adult equivalent.

Table 9a: Estimates of period 2 Poverty using period 1 diversification variables as regressors

Dependent variable	Log consumption						Poverty incidence (1=poor, 0=non-poor)								
	OLS estimates			*IV 2SLS estimates*			*LPM estimates*			*IV- LPM*			*Probit estimates*		
	Coef.	std error	t-values	Coef.	std error	z-values	Coef.	Std. Err.	t-values	Coef.	Std. Err.	z-values	Coef.	Std. Err.	z-value
Share of non-agric income 1992	**0.15**	0.076	2.01	2.00	2.752	0.73	-0.03	0.066	-0.46	0.437	1.659	0.26	-0.09	0.196	-0.45
No. of primary schools in community in 1999	**0.08**	0.032	**2.5**	***0.11***	0.068	***1.67***	-0.03	0.027	-0.99	-0.018	0.041	-0.44	-0.08	0.083	-0.95
Northern (regional dummy)	-0.13	0.079	-1.69	-0.19	0.144	-1.32	0.10	0.069	1.48	0.091	0.087	1.05	0.33	0.207	1.6
Eastern(regional dummy)	**-0.22**	0.063	**-3.42**	-0.30	0.179	-1.7	**0.20**	0.054	**3.59**	0.153	0.108	1.42	**0.60**	0.166	**3.6**
Western(regional dummy)	**-0.22**	0.073	**-3**	0.50	1.045	0.48	0.16	0.063	2.5	0.307	0.630	0.49	**0.50**	0.193	**2.61**
Household size (1999)	**-0.04**	0.007	**-5.74**	**-0.04**	0.011	**-3.85**	**0.02**	0.006	**4.02**	**0.025**	0.007	**3.77**	**0.07**	0.018	**4.02**
Sex of household head	**0.11**	0.050	2.19	0.13	0.080	1.57	-0.04	0.043	-0.84	-0.031	0.048	-0.65	-0.12	0.130	-0.89
Access to electricity in community(1999)	-0.08	0.060	-1.39	-0.17	0.160	-1.09	0.03	0.052	0.55	-0.002	0.096	-0.02	0.09	0.154	0.61
Availability of private clinic in community(1999)	**0.08**	0.036	2.15	0.10	0.063	1.54	-0.04	0.031	-1.41	-0.031	0.038	-0.81	-0.14	0.093	-1.46
Log of agric. wages in community(99)	0.03	0.035	0.94	0.09	0.103	0.89	-0.05	0.030	-1.53	-0.031	0.062	-0.49	-0.13	0.093	-1.43
Age of household head	**0.002**	0.001	1.84	0.002	0.002	0.8	***-0.002***	0.001	***-1.68***	***-0.003***	0.001	***-1.87***	***-0.01***	0.003	***-1.75***
Constant	8.72	0.297	29.4	6.75	2.965	2.28	0.62	0.256	2.42	0.142	1.788	0.08	0.37	0.787	0.47
No. of observations	495			464			495			464			495		
Root Mean square Error	0.52			0.774			0.452			0.467					
Instrumented	Share of non-agric.income (1992)														
Instruments	Labour-land ratios in 1992, Log of non-farm wages in 1992, Number of income sources in 1992														
Hausman test: IV-2SLS and OLS estimates	chi2(11)= 0.62 Prob>chi2 = 1.0000														
Hausman test :IV- LPM & LPM estimates	chi2(12) = 19.72 Prob>chi2 = 0.0725														
Hausman test: Probit and LPM estimates	chi2(11)= 19.60 Prob>chi2 = 0.0512														

3.24 Discussion of the determinants of Household Poverty (Welfare) in Uganda

Table 9a above shows the determinants of household welfare in terms of both consumption and poverty incidence. OLS estimates show that diversification proxied by the household's share of non-agricultural income significantly increases consumption. i.e. the more diversified the household the higher the consumption per adult equivalent. Increased access to primary education as proxied by the number of primary schools within the community significantly increases household consumption. Though not significant in the LPM and probit estimates, the negative coefficients on this variable in these specifications shows that access to primary education is poverty-reducing. Increased household size significantly reduces consumption per adult equivalent. The significant negative effect of household size on welfare in terms of both consumption and poverty incidence is robust across all the specifications of the consumption equation . This is an indication of the potentially damaging effect of population growth on poverty reduction efforts.

Households headed by older heads have significantly better welfare in terms of increased consumption and reduced poverty than those headed by younger heads. This result is robust across the OLS, LPM, IV-LPM and the probit specifications of the consumption equation. OLS estimates further show that the availability of a private clinic within the community significantly improves household welfare in terms of consumption. Though the result is not significant in other specifications the negative coefficients in the LPM and probit estimates show that access to health services is also poverty-reducing.

The estimates also show marked regional imbalances in welfare in Uganda. Relative to the central region of Uganda, household consumption was significantly lower in the eastern

and western regions of Uganda an indication that welfare in Uganda was heterogeneous during the study period.

Specification issues

Hausman tests: at the 5% significance level, the p-values of the hausman tests between the IV-2SLS and OLS estimates of consumption, IV-LPM and LPM estimates of poverty, and probit and LPM estimates of poverty incidence are not significant. We therefore fail to reject the null hypothesis of no systematic difference between the coefficients (estimates). This implies that conditioning on the lagged diversification variables in the consumption/poverty equations is valid.

Testing for over-identifying restrictions in Consumption equation

For the period 2 poverty estimation above, $nR_1^2 = 464\,X\,0.0005 = 0.232$ is far less than the 5% critical value for the chi_square distribution with 2 dfs which is 5.9914 . We fail to reject the null hypothesis. Therefore, the variables used to instrument for diversification pass the over-identification test.

Testing the Pull diversification hypothesis

$H_0 : \delta_{diversification} = 0$ against $H_1 : \delta_{diversification} > 0$

The 5% critical value c, for the normal distribution is 1.645. The t-value for period 1 diversification in the OLS period 2 levels consumption equation is 2.01. Since $t_{\beta_{diversification}} > c$, we reject the null hypothesis. Therefore, the impact of period 1 diversification on period 2 consumption is significantly positive. Thus, diversification in manifested in terms of increasing share of non-agricultural incomes in Uganda is largely driven by pull factors and

is mainly opportunity-led. On the contrary household diversification manifested in terms of the number of income sources has a significant negative effect on consumption and may be poverty-perpetuating over time. This is shown in table 9b below where the number of income sources in 1992 has a significant negative effect on 1999 household consumption.

Table 9b: Impact of 1992 number of income sources on 1999 consumption

log Consumption I 1999	**Coef.**	**Std. Err.**	**t**	**P>t**
Number of income sources in 1992	-0.239	0.099	-2.41	**0.026**
area (urban/ rural)	-0.074	0.378	-0.2	0.846
No. of primary	-0.081	0.243	-0.33	0.743
Northern (regional dummy)	(dropped)			
Eastern(regional dummy)	-0.085	0.263	-0.32	0.749
Western(regional dummy)	(dropped)			
Household size (1999)	-0.080	0.040	-1.97	**0.063**
Sex of household head	-0.155	0.348	-0.45	0.661
Access to electricity in community(1999)	-0.103	0.493	-0.21	0.837
Availability of private clinic in community(1999)	0.114	0.198	0.58	0.571
Age of household head	0.002	0.007	0.27	0.791
Log of agric. wages in community(99)	(dropped)			
_cons	10.13252	0.945	10.72	0

3.30 ANALYSING THE DETERMINANTS OF HOUSEHOLD DIVERSIFICATION AND TESTING THE 'PUSH DIVERSIFICATION HYPOTHESIS IN UGANDA

3.31 Testing the Push-Diversification hypothesis

The "Push hypothesis'' implies that consumption negatively affects diversification but does not necessarily imply any link from diversification to poverty i.e. that low incomes or poverty may lead to greater diversification.

For simplicity I suppose that there is a single diversification variable *w*. A parallel approach then estimates the levels equation

$$w_{h2} = b' x_{h2} + c' z_h + d' y_{h1} + \varepsilon_h \quad (h = 1,..., H) \qquad (6)$$

The hypotheses to be tested are $H_0 : d = 0$ against $H_0 : d < 0$ .Here, other poverty measures like poverty incidence can be included in place of consumption per adult equivalent as well.

Controlling for the possibility of unobserved heterogeneity in the diversification estimation

In order to control for possible inconsistency of estimates due unobserved heterogeneity in the 2000 diversification equation, I instrument the lagged poverty variable with the lagged regressors including per capita land owned by the household in 1992,ownership of a non-crop enterprise in 1992 and age of the household head in 1992. These variables are highly correlated with poverty in the poverty estimation in section 4.5 above but may not be correlated with the error term in the diversification equation.

Table 10: Estimates of period 2 diversification using Period 1 Poverty variables as regressors

Poverty variable used	Consumption per Adult equvalent 1992						Poverty Incidence (poor=1, 0=non-poor)					
	OLS estimates			IV estimates			OLS estimates			IV estimates		
HH Share of Non-agric. Income	**Coef.**	**Std. Err.**	**t-values**	**Coef.**	**Std. Err.**	**z-values**	Coef.	Std. Err.	t	**Coef.**	**Std. Err.**	**z-values**
Poverty 1992	0.007	0.019	0.38	0.157	0.390	0.4	-0.01	0.035	-0.29	-0.76	1.930	-0.39
Urban (area dummy)	0.058	0.033	1.78	0.107	0.132	0.81	0.06	0.032	1.76	0.16	0.269	0.59
semi-urban(area dummy)	**-0.120**	0.059	**-2.03**	***-0.112***	0.066	***-1.7***	**-0.12**	0.059	**-2.02**	-0.07	0.143	-0.52
Eastern	-0.008	0.030	-0.27	-0.020	0.045	-0.45	-0.01	0.030	-0.25	0.00	0.042	-0.1
Western	**0.116**	0.031	**3.75**	**0.118**	0.033	**3.59**	**0.12**	0.031	**3.75**	**0.12**	0.045	**2.69**
Electricity in community(1=yes, 0=no)	0.017	0.028	0.6	0.014	0.030	0.47	0.02	0.028	0.6	0.02	0.039	0.44
Credit access constraint(1=yes,0= no)	-0.062	0.079	-0.78	-0.086	0.103	-0.83	-0.06	0.079	-0.78	-0.11	0.163	-0.66
Soil fertility constariants(1=yes, no0	0.103	0.071	1.45	0.120	0.087	1.38	0.10	0.071	1.46	0.23	0.343	0.67
Non-farm wages(shs/manday)	**-0.0001**	0.0001	**-2.29**	**-0.0001**	0.0001	**-2.11**	**-0.0001**	0.0001	**-2.27**	-0.0001	0.0002	-0.3
HH Labour -land ratios	**0.006**	0.002	**2.59**	**0.007**	0.003	**1.97**	**0.01**	0.002	**2.59**	0.01	0.012	0.86
HH Dependency ratio	**0.059**	0.019	**3.1**	**0.060**	0.020	**2.97**	**0.06**	0.019	**3.08**	0.05	0.044	1.04
Sex of Household head	**0.061**	0.026	**2.38**	***0.055***	0.032	***1.7***	**0.06**	0.026	**2.39**	0.04	0.060	0.72
Education level of hh head(years)	**0.007**	0.003	**2.53**	**0.007**	0.004	**2.1**	**0.01**	0.003	**2.52**	***0.01***	0.005	***1.66***
_cons	0.380	0.203	1.87	-1.039	3.696	-0.28	0.45	0.100171	4.47	0.46	0.145	3.2
No.of observations	487.00			487			**487.00**			487.00		
Root Mean Sqaure Error (RMSE)	0.27			0.280			0.267			0.370		
Instrumented variables	Log consumption per AE 1992, poverty incidence 1992											
Instruments	HH per capital land owned 1992, Ownership of non-crop enterprise in 1992, age of household head 1992											

3.32 Discussion of the determinants of Household Poverty (Welfare) in Uganda

OLS and IV estimates of the diversification equation in table 10 above show that non-farm wages, household labour land ratios, household dependency ratios, sex of the household head and education of the household head are the significant variables that influence the level of household diversification in Uganda. Moreover,the results are robust across the different specification of the diversification equation in table 10.

The higher the cost of non-farm labour in terms of non-farm wages , the lower the rate of diversification in terms of share of agricultural income. Households are less likely to engage in non-agricultural activities if the cost of hiring labour to work in these activities increases. Labour-land ratios significantly increase diversification into non-agricultural activities. As the pressure on small pieces of cultivable arable land increases, household are pushed into engaging into other non-farm activities or selling their labour off-farm. The higher the ratio of non-working members to working members in the household (dependency ratios) the higher the extent to which household diversify into non-agricultural activities in order to support their livelihoods. Male headed households and households with more educated household heads are more likely to engage in non-agricultural activities when compared to female headed and less educated household heads respectively.

There are also heterogeneity in diversification levels across regions, and between rural and urban centers in Uganda. Relative to rural areas, semi-urban are significantly less

diversified in terms of the share of income they derive from non-agricultural incomes. Households in the western region of Uganda are significantly more diversified than those in the central region.

Testing for over-identifying restrictions in the period 2 diversification equation

For the period 2 diversification estimation above, $nR_1^2 = 487\ X\ 0.004 = 2.1428.$ is far less than the 5% critical value for the chi_square distribution with 2 dfs which is 5.9914 . We fail to reject the null hypothesis. Therefore, the variables used to instrument for poverty pass the over-identification test.

Testing the Push hypothesis in the Period 2 diversification equation

$H_0 : \delta_{Poverty} = 0$ against $H_1 : \delta_{Poverty} < 0$

The 5% critical value c, for the normal distribution is 1.645. The t-value for period 1 poverty in the OLS period 2 levels diversification equation is 0.29 . Since $t_{\beta_{Poverty}} < c$, we fail to reject the null hypothesis. Therefore, the impact of period 1 poverty on period 2 diversification is significantly positive. There is therefore no evidence that low incomes or poverty, lead to greater diversification in Uganda.

4.0 Analysing the Determinants of Activity portfolios in Uganda

In order to analyze the determinants to the activity portfolios in which households are engaged, I divide households into four mutually exclusive portfolio groups or strategies depending on the combination of activities they undertake for their livelihoods. Household categories include;

- Farming-only households that depend solely on agriculture for their incomes
- Farming-enterprise households that combine farming and non-crop enterprises as a source of their livelihoods
- Farming–wage household whose members part-time in both agriculture and wage employment on and off farm and
- Farming-wage-enterprise that combine all the three activity portfolios for their livelihoods.

Estimation procedure

Suppose there are *m* mutually exclusive choices so *m=4* as in the activity portfolio case above; Define $y_{ij} = 1|(j = 1...m)$ if individual *i* chooses alternative *j* , and zero otherwise.

Let $p_{ij} = \Pr(y_{ij} = 1 | a_i, x_{ij})(j = 1...m)$. Just one action must be selected so $\sum_{j=1}^{m} p_{ij} = 1$

The plausible model to use for estimation in this case is the multinomial logit model whose coefficients show the importance of a given independent variable in choosing a

particular alternative j, relative to a base category which is one of the available alternatives to choose from.

The multinomial logit model is based on McFadden utility function which is

$$u_i^j = \alpha' x_i^j + \gamma_j' a_i + \varepsilon_i^j \_ \beta_j' z_i^j + \varepsilon_i^j = \bar{u}_i^j + \varepsilon_i^j (j = 1...m)$$

In multinomial logit, $p_{i1} = \frac{e^{\alpha' x_i^1 + \gamma_1' a_i}}{\sum_{j=1}^{m} e^{\alpha' x_i^j + \gamma_j' a_i}} = \frac{e^{\bar{u}_i^1}}{\sum_{j=1}^{m} e^{\bar{u}_i^{j1}}}$

The utilities $\bar{u}_i$ can be replaced by an indicator variable *I* with the same interpretation and estimation is done by maximum likelihood. The multinomial logit model makes a strong assumption of the independence of irrelevant alternatives often referred to as the "red bus, blue bus problem. This assumption is that the odds of choosing one alternative are unaffected by factors relating to a second alternative even when the two alternatives are closer substitutes when compared to a third alternative. The change in attractiveness of one of the two closely substituting alternatives would be predicted to leave the relative probabilities of choosing the other of the close substitute choices relative to the third alternative unchanged which is implausible[9]. I ran a multinomial logit model using in household activity portfolios as the dependent variable and other diversification determinats as independent variables . Here, I use using farming households as the base category. Results are shown in table 11..

4.10 Discussion of estimated results

[9] This problem can be resolved using the Mixed Multinomial Logit model

From Table 11 below, household size, age and sex of the household head and land owned per capita are the significant factors determining activity portfolios that households diversify into. Relative to farming households, households headed by females and those headed by older persons are less likely to combine farming with non-crop enterprises for a livelihood while larger households are more likely to undertake this activity portfolio. Relative to the farming only group, households headed by an older person are less likely to combine farming with wage labour for a livelihood while those households with higher labour land ratios are more likely to combine farming while hiring out excess household labour both on and off-farm.

Relative to households solely dependent on farming, households with more educated heads are more likely to undertake a non-crop enterprise in addition to farming and undertake larger portfolios entailing farming, enterprise and wage labour as shown by the significant coefficient on education in columns 2 and 4 of Table 13.

Table 11: Multinomial logistic regression of the determinants of household activity portfolios

Diversification group[10]	Farm-enterprise household		Farm-wage household		Farm-enterprise-wage household	
	Coefficient	p-value	Coefficient	p-value	Coefficient	P-value
Area	-0.088	0.768	0.192	0.565	0.661	0.226
Central	0.374	0.342	-0.063	0.893	0.521	0.561
Northern	0.175	0.656	-0.412	0.368	0.619	0.486
Eastern	0.452	0.193	0.376	0.314	1.455	**0.052**
Log transport costs	-0.011	0.956	0.071	0.767	0.034	0.927
Education of head	0.083	**0.028**	0.042	0.341	0.334	**0.00**
Sex of household **head**	-0.726	**0.006**	-0.351	0.234	-0.278	0.611
Age of household head	-0.029	**0.000**	-0.031	**0.000**	-0.011	0.488
Household size	0.068	0.081	0.011	0.81	-0.116	0.199
Log non-farm wages	0.030	0.762	-0.171	0.063	-0.042	0.795
Per capita Land	0.005	0.927	0.002	0.975	-1.037	**0.027**
Log per capita Wealth	-0.008	0.950	-0.207	0.133	0.057	0.817
Intercept	0.809	0.729	3.363	0.218	-3.221	0.504
Log likelihood	-493.8					
Observations	462					
Pseudo R^2	0.094					

[10] Farming only households is the comparison/base category

5.00 Conclusions

Based on the findings from the study, conclusions are drawn around the following broad themes.

Characterizing diversification and identifying the efficient diversification strategy for welfare growth and poverty reduction in Uganda.

Results show that income diversification achieved through increasing the share of non-agricultural incomes and varying the portfolio of income activities is opportunity-led. This may not be the same case with diversification achieved through increasing the number of income activities Increasing the number of income activities in agriculture-related activities may potentially perpetuate poverty if households simply increased the number of income activities for safety reasons. The findings show that the more varied the portfolio of activities the household was engaged in, the higher the share of income it derived from non-agricultural activities.

Thus, gains in welfare and poverty reduction from household diversification in Uganda are mainly derived from the variation in portfolios or enterprise types undertaken by households as opposed to increasing the number of activities in the same sector. Diversification policy should therefore aim at increasing household skills and assets in order to benefit from economies of scope (complementarities) between different portfolios of farm and non-farm activities while simultaneously insuring against income risk. 11he factors that favour profit led diversification include education and asset wealth. Increased household size and agricultural constraints (like poor soil fertility and

lack of access to input and output markets) simply push households into diversifying. Increased non–farm wages affect income diversification negatively. Given this analysis at household level, it is interesting to how the balance of desperation-led and profit–led diversification works out at aggregate community level. This is the subject of chapter 5.

Identifying and targeting most vulnerable sectors /groups in the Ugandan economy

Despite widespread poverty within the mainly rural agricultural households, the findings in Table 5 show that long term poverty rates within the mainly wage-dependent households were no better. Compared to self-employed households in the agricultural and non-agricultural sectors, both poverty incidence and poverty gaps were higher among wage-dependent households over time. Self-employed non-agricultural households saw a 50% decline in poverty prevalence from 20% to 10% and a bigger decline in poverty gap (i.e. from 6.2% to 2.7%), when compared to wage-dependant households whose poverty gap increased over time (See Table 3). This suggests that private-public partnerships to encourage local enterprises in the non-formal sector to thrive might potentially complement formal wage labour markets in improving the quality of employment and subsequently reducing poverty over time. Thus, in addition to improving agricultural productivity to lower food prices for urban workers, safety net programs should include the working-poor households in urban and semi-urban areas who may be worse-off than the poor in the agricultural sector.

c) Ingredients of long term poverty policy

The findings from the poverty analysis show diversification, household size, availability of primary schools in communities, availability of clinins in communities, sex and age as the major variables affecting household welfare and poverty over time. Therefore long term poverty reduction efforts and policies in Uganda should aim at controlling population growth, supporting households to undertake diversified portfolios of activities which benefit from economies of scope (complementarities).Improving agricultural productivity also helps to boost diversification through a reduction in non-agricultural wages as food prices fall.

Other measures might include increasing access to education services and health services Improving food security through programmes aimed at increasing agricultural productivity especially in rural areas can help to tackle rising non-farm wages, thus helping to spur the non-agricultural sector. Improving food security entails the use of high crop yielding varieties to increase output per unit of land or measures to improve soil fertility as population pressure on arable land increases over time

Another important policy measure is the implementation of appropriate land policies to improve land use efficiency through secure land-use rights for poor people, and land titling which provide collateral, thus increasing credit access to help poor households further diversify their incomes. As shown by the poverty break-down analysis, there is need to tailor poverty policy in order to suit different the needs of different regions and sectors in the country, and improve the targeting of poverty interventions and program. This will greatly increase the returns to poverty reduction from these interventions.

Chapter 4 Appendix 1:

Table 1: Consumption Patterns across Activity Groups by Quintiles

	Consumption/AE 1992					Consumption/AE 2000				
	%household in quintiles					%household in quintiles				
a) Activity group	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
Not applicable	16	10	14	12	11	12	16	13	15	18
Agriculture	41	40	40	33	30	72	73	68	65	64
Other primary	2	1	2	4	2	1	1	2	1	1
Trade & Manufacture	19	23	17	24	22	5	5	7	9	8
Services	22	27	27	27	34	10	6	10	10	9
Total	100	100	100	100	100	100	100	100	100	100
b) Diversification group	Consumption quintiles 1992					Consumption quintiles 2000				
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
farming_only household						46	42	45	42	48
Non_farm household	34	40	44	47	55	7	6	10	10	11
Farm-enterprise household	57	51	50	50	39	24	26	24	25	24
Farm_wage household	8	10	7	2	6	18	20	17	20	11
Farm_enterprise_wage household						5	5	5	4	6
Total	100	100	100	100	100	100	100	100	100	100
c)No. of income sources	Consumption quintiles 1992					Consumption quintiles 2000				
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
1	32	37	36	37	41	4	5	7	7	11
2	34	32	29	34	34	35	29	30	28	28
3	27	25	28	24	20	44	43	43	44	43

4	8	7	6	4	6	14	18	16	18	16
5	0	1	1	0	0	3	5	4	3	2
6						0	0	0	1	0
	100	100	100	100	100	100	100	100	100	100
d) Enterprise type	Consumption quantiles 1992					Consumption quantiles 2000				
	1	2	3	4	5	1st	2nd	3rd	4th	5th
None	67	56	48	45	32	51	49	48	48	48
Primary production	5	8	7	6	8	12	17	9	10	11
Primary Processing	10	7	8	9	14	14	7	12	7	9
Trade	18	28	35	39	44	15	16	15	22	23
Service industry	0	2	2	1	2	7	11	16	13	10
Total	100	100	100	100	100	100	100	100	100	100

Appendix2:Testing for possible selection bias due to filtering sample of panel households

Procedure1; In order to test for possible selection bias arising from re-sampling and filtering panel households from the 1992 and 2000 household surveys, I estimated a probit model of the factors that determines the probability that a household sampled in 1992 was re-visited in 2000. Here, the dependent binary variable takes on values 1 if a household is panel household and 0 otherwise. I include regional dummies, dummies for whether community is rural, urban or a town, household size, household income, literacy and sex of the household head as regressors. My aim is to generate inverse Mills ratios from this estimation which I can use to test for selection bias that might have resulted from over-sampling of poor households during the household survey. I then include the inverse Mills ratios in subsequent poverty regressions to determine whether their coefficients are significant. This is the so-called Heckman procedure. A significant co-efficient on the inverse Mills ratios indicates the possibility of sample selection bias (Heckman 1976, 1979).

Table 2 : Probit model for the probability being a panel household

Re-sampled	Coefficient	P-
Regional dummies		
Central	0.2042	0.000
Eastern	0.1821	0.001
Western	0.2841	0.000
Area dummies		
Urban area	0.0533	0.629
Rural area	0.8071	0.000
Log of household income	-0.0292	0.23
Household characteristics		
Share of _educated members in household	0.0004	0.978
Household size	0.0385	0.000
Sex of the household head(1=male 0=female)	-0.0107	0.931
Poverty status of household(1=poor, 0=non-poor)	-0.0661	0.133
Intercept	-1.8936	0.000
Log likelihood	-2973.446	
Number of observations	9698	
Pseudo R^2	0.0641	

Relative to household in Northern Uganda, households in the other parts of the country (i.e. the West, East and Central areas) were more likely to be re-visited in 2000 owing to the civil strife in Northern Uganda in 2000. In addition rural and larger households were significantly more likely to be revisited in 2000. Rural households are much easier to locate since they are less mobile than urban and semi-urban households that may shift to different locations over time. Larger households are more likely to be re-sampled because there are higher chances of finding someone to interview even when previous respondents have migrated.

Procedure 2: Testing for selection bias in the consumption equation

The Heckman procedure is not strictly valid in a Maximum Likelihood context. The correct procedure entails jointly estimating the consumption and the selection equations using Maximum Likelihood. This is complicated and cannot be done using standard software. The second problem is identification. For the Heckman procedure to be identified, one needs to have variables in the selection equation which are absent from the consumption equation.

Random effects estimates in Table 3 below show that the coefficient on the inverse Mills ratios is not significant consistent with the absence of selection bias in the consumption regression I therefore re-run the model using the fixed effects estimation excluding the inverse Mills ratios.

Table 3: Testing for selection bias using the random effects estimation

log consumption per AE	Coef.	Std. Err.	z
Share of hh non-agric. income	0.643793	0.735639	0.88
Log per capita Wealth	0.066035	0.220365	0.3
Credit access constraints	0.070661	0.123943	0.57
Soil fertility constraints	-0.20634	0.138361	-1.49
Household size	-0.00717	0.003648	-1.97
Output market constraints	0.026338	0.080547	0.33
Area (1=Urban 0=Rural)	0.043452	0.059066	0.74
Log of agric. wages in community	-0.12711	0.164853	-0.77
Proportion of hh buying food in dry period	0.016781	0.024681	0.68
Dependency ratio	-0.05851	0.026401	-2.22

Household literacy rate	-0.00658	0.006878	-0.96
Millis ratios	0.27957	1.417717	0.2
_cons	8.804036	2.816745	3.13

Reduced form equations used to examne the presence of causal link between diversification and poverty

Table 4 (a) Estimating the reduced form consumption equation

log of Consumption per AE	**Coef.**	**t-**	**P>t**
AREA(urban ,rural)	0.0527	0.56	0.576
Log of per capita HH wealth	**0.0491**	**2.05**	**0.041**
Credit constraints(Yes, No)	0.1063	0.67	0.503
Soil fertility constraints (yes, no)	-0.2126	-1.55	0.121
Output market constraints (yes, no)	0.0184	0.19	0.852
Land_access constraints (yes, no)	**0.1829**	**1.77**	**0.078**
Input market constraints (yes, no)	0.1588	1.5	0.134
Household size	**-0.0303**	**-3.33**	**0.001**
Proportion of HHs buying food in lean period	0.0193	1.38	0.169
HH Dependency ratio	**-0.0733**	**-2.1**	**0.036**
HH Literacy rate	0.0019	0.21	0.836
Ownership of a non-crop enterprise	**0.2196**	**4.89**	**0.000**
Log of non-farm wages	**-0.3197**	**-3.51**	**0.000**
Labour -land ratios	-0.0105	-1.34	0.179
_cons	10.6174	16.15	0.000
No. of observations	1866		

Table 4(b): Estimation of the diversification reduced form equation

HH share of non-agricultural income	**Coef.**	**t-**	**P>t**
AREA(urban ,rural)	0.063	1.15	0.252
Log of per capita HH wealth	0.0004	-0.03	0.975
Credit constraints(Yes, No)	0.045	0.49	0.628
Soil fertility constraints (yes, no)	0.113	1.4	0.161
Output market constraints (yes, no)	0.032	0.54	0.586
Land_access constraints (yes, no)	0.037	0.61	0.541
Input market constraints (yes, no)	0.188	3.02	**0.003**
Household size	-0.013	-2.41	**0.016**
Proportion of HHs buying food in lean period	0.009	1.12	0.265
HH Dependency ratio	0.002	0.11	0.915
HH Literacy rate	-0.004	-0.71	0.479
Ownership of a non-crop enterprise	-0.001	-0.04	0.968
Log of non-farm wages	-0.413	-7.7	**0.000**
Labour -land ratios	0.000	-0.09	0.925
Constant	3.193	8.27	0.000
No. of observations	1866		

Table 5(a): Fixed effects estimation of the "Push'' diversification equation(Unrestricted model)

HH share of non-agricultural income	**Coef.**	**t-values**	**P>t**
log_Consumption per Adult Equivalent(AE)	-0.019	-0.97	0.332
AREA(urban ,rural)	0.064	1.16	0.245
log of per capita HH wealth	0.001	0.04	0.972
Credit constraints(Yes, No)	0.047	0.51	0.612
Soil fertility constraints (yes, no)	0.109	1.35	0.178
Output market constraints (yes, no)	0.032	0.55	0.582
Land_access constraints (yes, no)	0.041	0.67	0.505
Input market constraints (yes, no)	0.191	3.06	**0.002**

Household size	-0.013	-2.5	**0.012**
Proportion of HHs buying food in lean period	0.010	1.16	0.247
HH Dependency ratio	0.001	0.04	0.969
HH Literacy rate	-0.004	-0.7	0.483
Ownership of a non-crop enterprise	0.003	0.12	0.907
Log of non-farm wages	-0.419	-7.76	**0.000**
Labour -land ratios	-0.001	-0.14	0.891
Constant	3.397	7.73	0.000
No. of observations	1866		
Residual Sums of Squares (unrestricted	130.85		
Numerator degrees of freedom	15		
Denominator degrees of freedom (n-k-1)	1851		

5(b) Fixed effects estimates of the "Push'' diversification equation(Restricted model)

HH share of non-agricultural income	Coef.	t-values	P>t
Log Consumption per Adult Equivalent(AE)	-0.0169	-0.86	0.391
Area(urban ,rural)	0.0614	1.11	0.268
log of per capita HH wealth	0.0007	0.05	0.96
Household size	-0.0135	-2.5	0.013
Proportion of HHs buying food in lean period	0.0142	1.77	0.076
HH Dependency ratio	0.0019	0.09	0.925
HH Literacy rate	-0.0038	-0.7	0.485
Ownership of a non-crop enterprise	0.0064	0.24	0.812
Log of non-farm wages	-0.4323	-8.1	0.000
Labour -land ratios	-0.0003	-0.06	0.949
_cons	3.4798	7.98	0.000
No. of observations	1866		
Residual Sums of Squares(RSS-restricted)	132.42		
Number of exclusion restrictions on model , q	5		

i) Estimating the pull consumption equation including diversification as a regressor and excluding the consumption exogenous variables.

Fixed effects estimates of the "Pull " consumption equation (Unrestricted model)

Log_Consumption per adult equivalent	Coef.	t-values	P>t
HH Share of Nonagricultual income	-0.056	-0.97	0.332
AREA(urban ,rural)	0.056	0.6	0.551
log of per capita HH wealth	0.049	2.05	0.041
Credit constraints(Yes, No)	0.109	0.69	0.493
Soil fertility constraints (yes, no)	-0.206	-1.5	0.133
Output market constraints (yes, no)	0.020	0.2	0.838

Land access constraints (yes, no)	0.185	1.79	0.075
Input market constraints (yes, no)	0.169	1.59	0.112
Ownership of a non-crop enterprise	0.220	4.89	0.000
Log of non-farm wages	-0.343	-3.64	0.000
Labour -land ratios	-0.011	-1.35	0.178
Household size	-0.031	-3.4	0.001
Proportion of HHs buying food in lean period	0.020	1.41	0.159
HH Dependency ratio	-0.073	-2.09	0.037
HH Literacy rate	0.002	0.18	0.854
_cons	10.795	15.82	0.000
No. of observations	1866		
Residual Sums of Squares(RSS-unrestricted)	379.07		
Numerator degrees of freedom	15		
Denominator degrees of freedom (n-k-1)	1851		

Fixed effects estimates of the "Pull " consumption equation (Restricted model)

Log_Consumption per adult equivalent	Coef.	t-values	P>t
HH Share of Nonagricultual income	-0.033	-0.59	0.557
AREA(urban ,rural)	0.030	0.33	0.74
log of per capita HH wealth	0.085	4.44	0.000
Credit constraints(Yes, No)	0.114	0.73	0.465
Soil fertility constraints (yes, no)	-0.181	-1.34	0.181
Output market constraints (yes, no)	0.045	0.47	0.638
Land access constraints (yes, no)	0.160	1.59	0.112
Input market constraints (yes, no)	0.189	1.81	0.07
Ownership of a non-crop enterprise	0.205	4.69	0.000
Log of non-farm wages	-0.425	-4.71	0.000
Labour -land ratios	-0.022	-3.06	0.002
_cons	10.888	16.42	0.000
No. of observations	1911		
Residual Sums of Squares(RSS-restricted)	403.89		
Number of exclusion restrictions on model , q	4		

CHAPTER 5

Commodity Markets, Risk, and Poverty:

The determinants of income diversification at community level and effects on the conduct of agricultural commodity markets: Evidence from a panel of coffee-producing communities in Uganda.

Section 5.0: Introduction

Traditional discussions on agricultural producers in LDCs view income and activity diversification as "risk coping" responses in which households, lacking access to credit and insurance markets, sacrifice crop revenues for lower stable incomes to cope with price and output risk. I contend that this negative view of diversification fails to capture the opportunities in staple food markets and population growth arising over the past decade in Africa. Using the 1992/2000 panel of Ugandan communities, I estimate income diversification and coffee producer behaviour using the GLS Random effects, IV-random effects, Hausman-Taylor and the Fixed Effects estimators. These estimators trade-off consistency and efficiency in the estimates through differential control for community-specific effects and endogeneity in regressors. The findings are fairly robust and show a significant increase in non-agricultural incomes at community level between 1992 and 2000, with community wealth having a significant positive effect on diversification. This result favours an increase in profit-led diversification relative to desperation-led diversification at community level. Access to credit shows a significant

positive effect on diversification while increases non-agricultural wages significantly reduce diversification. The proportion of coffee producers in communities is significantly increased by diversification, land availability and credit access, and significantly reduced by land substitution with new staple cash crops like maize, and transport costs to the capital city.

For most producers of traditional agricultural export commodities, income diversification, both on and off-farm, is the norm rather than the exception. The factors underlying income diversification at household level include push and pull factors. Push factors include reduced marginal returns to labour as family labour working on fixed agricultural plots of land increases and insurance against risk and shocks. Pull factors include changes in rural infrastructure with respect to markets, health, education, roads, access to electricity etc all of which provide new opportunities to diversify away from agriculture at community level. (Barrett et al, 2001)

On one hand, price volatility in commodity markets, coupled with the seasonality of traditional agricultural commodities such as coffee and cotton, results in households allocating their labour to other activities during the off season to meet household consumption needs. On the other hand, the need to satisfy household food consumption leads households to allocating both land and labour between staple food crops and traditional cash crops for purposes of ensuring food security. In addition price shocks have important macroeconomic consequences between tradable and non-tradable sectors of the economy which warrant pro-active diversification policies

(Collier, 2005). These involve changes in agricultural output mixes in Sub-Saharan Africa besides the macro policy market reforms of the 1990s in order to shift domestic supply and demand for specific commodities and commodity groups (Delgado, 1995).

Traditional discussions of diversification in primary producing countries emphasize the need for households to diversify across activities to cope with price and output risk associated with specialization. Diversification is therefore a "risk coping" response in which households, lacking access to credit and insurance markets, on average sacrifice crop revenue to increase security (Dercon, 2005). I contend that this negative view of diversification fails to capture the opportunities that have become available over the past decade in which Africa has witnessed a minor resurgence in economic growth.

Over time, increased rural–urban migration in Uganda, which is a consequence of the fast rate of population growth, has increased the demand of staple food crops, specifically maize, cassava, bananas and potatoes, to feed the growing urban population. Further increases in the demand for staple food crops such as maize have resulted from increased prosperity in regional markets (Southern Sudan, drought-stricken parts of Western Kenya, mineral-rich conflict parts of the Democratic Republic of Congo (DRC) and Rwanda). This increased demand for food from both internal and new regional markets implies that staple food crops are likely to be increasingly competitive with traditional cash crops for both land and household labour. However, one major constraint to the competitiveness of staple food crops is the semi-open

nature of African Sub-Saharan African economies owing to the poor infrastructure, large distances and low volumes of production.

High transportation and other intermediation costs in semi-open economies may render traditional food staples and coarse grains like maize non-traded in countries in which they would be internally traded. In this is the case, increases in the domestic demand for staple foods cannot be met by imports of staple foods or imports of close price substitutes of the staples. Instead, the increased staple food demand is met by rising domestic relative prices to choke-off demand and stimulate an increase in production, the balance between the two responses depending on the elasticity of supply of the staples. Given that the supply of staples is usually not highly elastic with respect to price, staples are demand-constrained implying that net increases in rural demand for staples will not result in increased agricultural incomes through sustained increased production and higher prices (Delgado, 1995). For these reasons, it is interesting to explore diversification patterns into other activities and staple food crops in order to determine the main factors that underlie these patterns and the subsequent impacts on the productivity traditional agricultural commodities like coffee and cotton.

According to Delgado (1995), the elasticity of supply of non-tradeables is of strategic importance in semi-open economies because it determines whether success in stimulating household incomes through tradable sectors (such coffee and cotton) leads to further income growth in the non-tradable sectors (e.g. staple foods) or to just more inflation of non-tradable staple food prices. In the context of increased food demand,

inelastic supply of non-tradable food crops is likely to lead to higher prices for staple foods relative to prices of agricultural exports like coffee. Higher food prices are likely to increase wage demands thus decreasing competitiveness in traditional cash crop sector under growth conditions with inelastic supply of non-tradables with respect to prices. This suggests that the development of the food and non-food sectors is complementary and mutually required in Africa's semi-open economies.

A number of recent studies show increased income diversification as household incomes increase leading to wedge between already well-off households (who have resources to venture into more profitable non-farm enterprises) and poor households who are not well endowed with resources. (Barrett et al, 2001). This observation runs contrary to the notion of diversification against risk with further perpetuates poverty as poor households diversify into low return and low risk activities. On one hand, income diversification at household level may lead to decreased agricultural production as households invest into more profitable activities off farm. On the other hand it could boost agriculture when incomes from non-farm sources are used to purchase agricultural inputs. Recent diversification literature shows that as regions grow, different households take different diversification paths depending on their endowments in land and human capital, plus proximity to markets. Therefore, not everyone diversifies completely away from agriculture (Smith et al, 2001).

Barrett, Bezuneh and Aboud (2001), studied the policy consequences (specifically, currency devaluation and food for work programmes) on diversification patterns (

reverse causality). They show that not everyone diversifies away from agriculture but rather that households have different diversification strategies and can transit from one strategy to another following changes in certain policies. Strategies include;

- *Full time farmer* strategy; usually undertaken by households with more land and capital; relatively high return strategy
- *Farmer and farm worker strategy;* this is for the poorest segment of landless households usually leading to low returns
- *Farm and skilled non-farm strategy;* Usually undertaken by highly qualified households taking up formal jobs while also doing farming ;Usually yields the highest returns from diversification
- *Mixed on-, off- and non-farm:* Also a low return diversification strategy undertaken by households with low on skills and land thus engaging in low return unskilled work off farm or seasonal activities like fishing , agricultural marketing while at the same time growing crops for food. These usually transit into farmer & farmer worker strategy during tough times.

In addition, emerging patterns in the diversification literature show a growing importance of non-farm income (about 40-45%) despite the "subsistence farmers" picture often painted about African agriculture (Bryceson & Jamal, 1997; Reardon 1997; Little et al, 2001). This pattern is reflected in the positive correlation between non-farm activity and income and or wealth (in the form of land or livestock) in rural Africa, seemingly offering a pathway out of poverty on one hand but also drawing a wedge

between well-off households that can access profitable non-farm activities and poor ones that get trapped in low entry barrier, low income activities.

It is therefore interesting to analyze the direction of causation among producers of traditional agricultural commodities. Do we see more non-farm diversification among higher commodity producers implying agricultural being the basis for diversification? Or do we see shifts away from traditional commodities to more profitable enterprises and staple crops? The latter would imply analysis of household diversification patterns on the basis of wealth or income clusters and not as homogenous entities.

In this chapter, I propose to analyse diversification within producers of traditional agricultural commodities, specifically coffee in Uganda, to determine how changes diversification into new food crops and activities have impacted on the production and welfare of both coffee producers in Uganda. The two main objectives of the analysis are

i) to tease out the major driving factors to income diversification among coffee producers over time,

ii) to test whether the broad range of factors that affect income diversification (land availability, non-agricultural wages, market access etc.) also affect crop portfolios.

In addition, I attempt to throw some light on two further issues:

iii) to determine the effects of activity diversification on the production and marketing of traditional cash crops and finally,

iv) to determine the impact of income diversification on household welfare in terms of incomes and income distribution among communities and households.

5.10: Conceptual framework

The conceptual framework below shows the relationships between households, commodity markets, the determinants of diversification and their subsequent impacts on poverty. Households which are located in communities own productive resources like land, labour and capital which they can allocate to the production of agricultural commodities or diversify into other activities off-farm. In commodity markets, there may be changes in both the productivity and number of producers involved in the production of traditional cash crops like coffee over time due to substitution and increased competitiveness of new commercial staple food crops like maize.

Conceptual framework

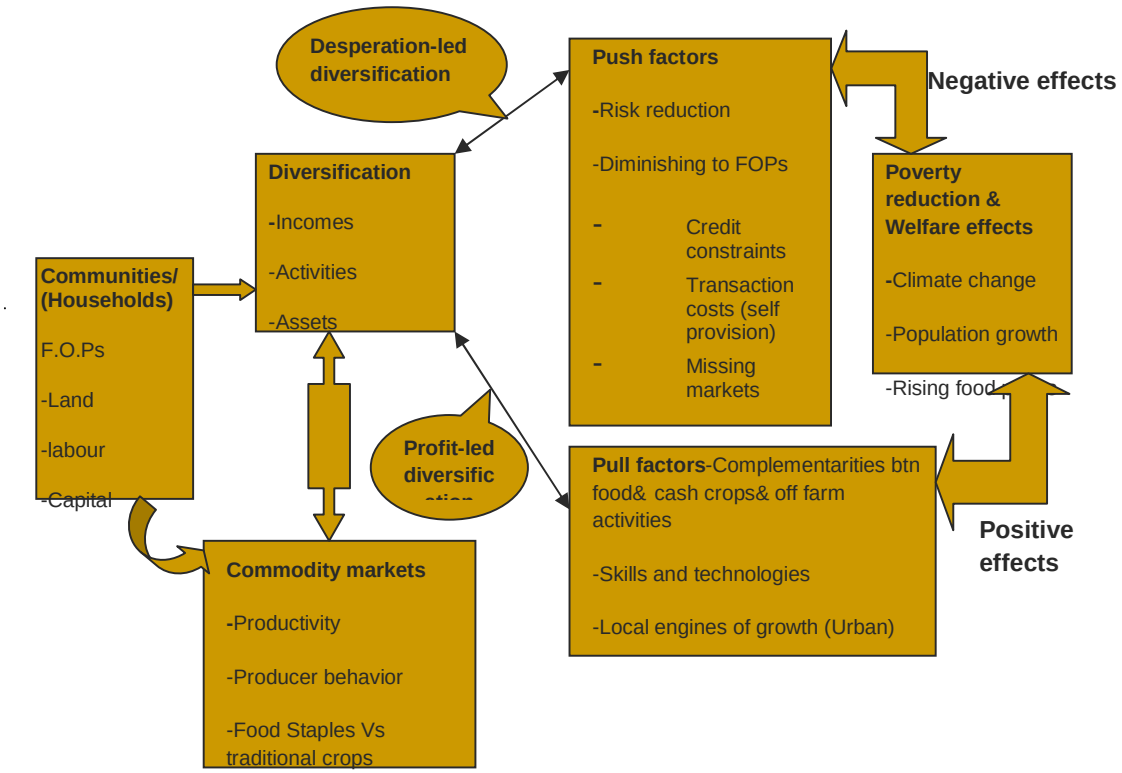


Figure 1: conceptual framework showing relationships between diversification in commodity markets and its impact on welfare

According to the conceptual framework above, household diversification may be in terms of incomes, activities or assets. It is may be driven by push factors like climate and price risk, diminishing returns to land productivity as the population increases, credit constraints leading households into self provision of goods and service, and missing markets in LDCs. This is desperation-led diversification that increases poverty. On the other hand, diversification may mainly driven by pull factors like economies of scope

due to complementarities between agricultural and non-agricultural enterprises, endowments with superior skills and technologies by households and local engines of growth like urbanisation which generates markets for different services and goods from households. Profit-led diversification is likely to increase household incomes and reduce poverty over time.

5.2 Economic theory behind agricultural productivity and diversification in commodity markets.

Coffee productivity and community diversification a re jointly determined because some variables that influence productivity also influence diversification. The productivity of traditional agricultural commodities over time at community level is influenced by both time-varying variables and time-invariant variables, which I will refer to as the community fixed effects.

Community fixed effects that influence the performance and conduct in agricultural commodity markets include location variables (such as distance from trading centres and cities). Location variables influence not only access to and availability of markets for traditional agricultural commodities but also the physical quantities produced as dictated by climate and soil conditions.

Time-varying variables affecting coffee productivity include changes in household wealth or productive assets over time, changes in the availability of cultivatable land and changes in coffee market variables in the community over time. Market variables include changes in prices and market availability at harvesting and prices in the

different coffee producing areas over time (between 1992 and 1999/2000). These variables may influence community diversification as well.

In addition, diminishing marginal returns to land which may be due to changes population pressure on land (reflected in labour to land ratios at community level) may affect productivity and community diversification as labour gets diverted away from agriculture into more productive activities over time.

Agricultural infrastructural factors that affect coffee productivity include changes access to agricultural extension services within the community, changes in availability of land for cultivation and sale, and changes in land tenure systems at community and district level. Others include changes in mechanization and agricultural technologies over time. The analysis will determine whether changes in agricultural infrastructure impact on the productivity and number of producers of coffee and how they impact on the commodity mix between traditional exports and staple food crops the over time.

Changes in labour variables: These relate to changes in agricultural wages relative to non-agricultural wages between 1992 and 1999/2000. These changes also determine the extent to which households diversify into non-farm activities, further supporting the view that income diversification the productivity are jointly determined.

Variables relating to the level of development of the community (whether urban, rural or semi urban) and agro-climatic conditions relating the weather patterns and soil

conditions of the region in which the community is located vary over time and affect coffee productivity as well.

Diversification variables: These include income from non-agricultural activities, diversification in assets and diversification in activities. Changes in diversification patterns across households affect may either increase or coffee productivity if incomes from other activities are invested into coffee. On the other hand, diversification patterns may reduce coffee productivity when labour and capital is diverted away into other crops and activities resulting into substitution effects with more competitive staple food crops like maize, banana, millet and cassava over time as will be shown in the analysis The essence of diversification variables is to determine whether income diversification at community and district level has affected changes in number of coffee and cotton producers and to what extent if at all. Since households diversify not only in income but also in assets and activities, the different measures of diversification will be compared in the analysis. Other variables that influence the productivity of coffee include the following;

a) Staple food production: Here, community and regional changes in the production and producers of staple food crops like maize, cassava, bananas and millet are used to capture substitution effects in production between traditional export commodities and new commercial food crops over time. (De Janvry et al, 1991)

b) Food security variables: These include changes in the proportions of households buying staple food crops in the lean period both in 1992 and 1999/2000.

a) Changes in community infrastructure over time: Here, changes related to roads, distances from main towns, time of accessing rural areas, availability of electricity in communities and their effects on commodity production and the commodity mix over time are captured.
b) Human capital: This captures the impact of changes in schooling and health variables on production patterns and the commodity mix within coffee-producing areas over time. They include changes in access to health and education, changes in the number of schools and health facilities, plus schooling levels in communities over time. Since well educated households are more likely to access lucrative non-farm opportunities, these changes could be useful in explaining diversification patterns and changes in commodity mix within communities.

The determinants of community diversification

Factors that drive household diversification patterns include; the levels of community development which determine the extent to which markets are available for other goods and services for households to diversify into. In addition, credit constraints at community level push households to diversify and become self sufficient while risk and shocks in terms of agricultural price volatility, weather failure and crop diseases lead households into diversification in order to smooth consumption. This is the so-called desperation-led diversification for poor households leading to highly diversified portfolios with low marginal returns (Barrett, 1997; Reardon et al, 2000: Little et al, 2001).

Other variables that drive household diversification patterns include changes in income and asset wealth over time, changes in constraints in land, labour and output markets which are reflected in changes in land transactions, number of land conflicts, market

availability in both factor and output markets plus relative changes in farm and non-farm wages over time. Human capital (from changes in education and health infrastructure), changes in food security levels and changes in infrastructure(e.g. roads and electricity) also influence community diversification

5.11 Working Hypothesis

Income diversification at community level in Uganda mainly driven by pull factors

If diversification is mainly driven by pull factors (profit-driven), I expect to obtain a significant positive coefficient on the lagged wealth variable in the diversification equation. This would imply that community diversification patterns among coffee producing communities are getting increasingly opportunity led and may reduce poverty in coffee-producing communities over time.

On the contrary, if community diversification patterns are mainly driven by push factors, I expect to obtain a significant negative coefficient on the lagged community wealth variable in the diversification equation. This would imply that diversification patterns among coffee producing communities are still desperation-led. Thus they are largely a mitigation or insurance measure against risk and push households to invest in low risk and low return activities to smooth consumption rather than invest in high return risky activities, thus further perpetuating poverty

5.20 Data and Methods

For this study, I use Uganda National Household Survey (UNHS) data for the years 1992 and 1999/2000 to extract community and household panels. Extracting the panels is possible because some communities and households surveyed in 1992 were re-visited again during the 1999/2000 household survey. In addition the 1999/2000 questionnaire contained some recall questions relating to the status of some variables during both 1999 and 1992. For the analysis in this paper, the two major variables of interest include farmer behaviour in commodity markets and diversification at community level over time.

From the 1999/1992 panel data set of Ugandan households and communities, I use the proportion of coffee farmers in the community to capture the conduct in coffee markets while the ordinal variable change in coffee productivity is used to capture the performance in coffee production.

The proportion of coffee producers is captured in the data set as an ordinal variable defined over 0 to 4. In the questionnaire, these ordinal values are translated as follows; "none" as zero, "few" as 1 , "about half" as 2 , "many" as 3 and "all" as 4. According to the questionnaire used to collect the data, these proportions have underlying percentage interval of producers of 0-5%, 6-25%, 25- 65%, 65-95% and over 95% respectively. The changes in the number of producers and productivity between 1992 and 1999 are coded as: "decreased a lot" coded as 1, "decreased a little" as 2, "remained the same" as 3, "increased a little" as 4 and "increased a lot" as 5. Despite

the fact that the changes in these variables are not quantified as a continuous variable, they give an idea of the magnitude of the differences in changes of coffee productivity and changes in the number of producers at an ordinal scale over time. I construct continuous variables out of the given proportion by taking mid values for each interval e.g. 2.5% for the 0-5% class used in the questionnaire.

Table 1: Summary of major variables, definitions and captured concepts

Community Variables	*Variable construction*	*Concept captured*
Log of non-agricultural Income	Log of non-agricultural income averaged over households in a given community	Income diversification
Proportion of coffee producers in community	Continuous variable constructed from ordinal measured in data with all (>95%), many (65-95%), about half (35-65%), few (5-35%), and none (<5%). Mid points of categories taken to construct continues variable constructed from ordinal	Coffee producer behaviour
Year Dummies	Year99, Year92	changes over time
Community development dummies	Very rural Rural Semi-rural Semi-urban Urban	Level of economic activity in community Access to community
Labour-land ratios	$\frac{\text{Mean community household size}}{\text{mean community acres owned}}$	Diminishing marginal returns to to land (population pressure on land)
Credit access	1=yes , 0= No	Credit constraints at community level
Log non-agricultural wages		Changes in off farm labour markets
Log Wealth		Community Wealth changes
Availability of cultivation land allocation practice	Yes=1, 0=No	Arable land availability in community
Proportion of maize producers	Similar as with coffee producers above	Substitution effects between
Community population	No. of households in community	Population measure
Coffee constraints dummies Lack of markets Poor Roads Crop Diseases Lack of Security Lack of Land Lack of credit Soil fertility	 lack of output markets poor roads coffee diseases Security land limitations lack of access to credit Poor soil fertility	Commodity market constraints
Log distance from Kampala	Distance is measure in kms	Community access

5.30 Descriptive Statistics

Table 2: Pair wise correlations and significance levels between Coffee production and diversification/market variables at community level

	Coffee Producers 1999	Producer change since 1992	Yield change since 1992	share enterprise income	share of remittances	coffee market availab-ility	Coffee market price
Producer change since 1992	0.1782 (0.0001)						
Yield change since 1992	-0.0817 (0.0803)	**0.5447** (0.0000)					
share enterprise income	**-0.2339** **(0.0000)**	**-0.1164** **(0.0115)**	-0.0215 0.6455				
share of remittances	**-0.1181** **(0.0057)**	**-0.1458** **(0.0015)**	-0.005 0.9148	0.262 0			
coffee market availability	**0.5985** (0.0000)	-0.002 0.9655	-0.3019 0	-0.2365 0	-0.2163 0		
Coffee market price	0.0198 0.7201	-0.038 0.491	0.062 0.2682	0.0876 0.1033	0.0766 0.1543	-0.0447 0.4129	
Availability of agricultural land 1999	-0.0313 (0.4909)	**-0.1821** **(0.0001)**	**-0.1571** **(0.0013)**	**0.1173** **(0.0007)**	0.1981 0	-0.0254 0.4776	0.0999 0.0735

p-values in parentheses

The share of remittance income at community level shows a significant negative correlation with 1999 coffee production. In addition, the share of remittance income shows a strong and significant positive correlation with the share of enterprise income indicating possible positive income effects on off-farm diversification among coffee producers. Market availability shows a significant positive correlation with coffee production while the land availability over time shows a significant negative correlation with coffee production indicating possible effects of decreasing marginal returns to farm

labour with increased population pressure on land. Though not significant, the share of enterprise income at the aggregate community level is negatively correlated with coffee production in 1999/2000 and significantly negatively correlated with the change in number of coffee producers since 1992. This indicates possible negative impacts of diversification on coffee production. However, such aggregation at community level may fail to capture what happens at household level.

Other categorical variables showing significant Pearson squared correlations with coffee production and producer changes include market availability, diseases, land availability, and food security. (See appendix, Tables 9, 10, 11 and 12).

5.31 Correlations between cash crop and staple food production

Changes in the proportion of maize and banana producers show high and significant negative correlations with changes in the proportion of coffee producers in 1999 indicating possible shifts from initially tradable coffee to new tradable staples (i.e. maize and banana). In addition maize and cassava yield changes are positively correlated as these crops are increasingly becoming major tradable staples in local markets.

Table 3: Correlations between coffee producers in 1999 and producers of staple crops in 1999

	coffee	Maize	cassava	banana
maize	**-0.518 (0.001)**			
cassava	0.113 (0.505)	0.206 (0.203)		
banana	**-0.674 (0.000)**	**0.554 (0.000)**	-0.082 (0.619)	
millet	0.168 (0.327)	0.248 (0.128)	**0.656 (0.000)**	-0.030 (0.860)

P-values in brackets

Table 4: Correlations between coffee producer changes since 1992 and staple crop producer changes since 1992

	Coffee producer change 92	Maize producer change 92	Cassava producer change 92	Bananas producer change 92
Maize producers in 1992	-0.296 (0.134)			
Cassava producers in 1992	-0.323 (0.100)	0.222 (0.208)		
Banana producers in 1992	-0.213 (0.276)	-0.301 (0.084)	**0.452** **(0.008)**	
Millet producers in 1992	-0.250 (0.218)	**0.372** **(0.0280)**	0.113 (0.518)	-0.021 (0.909)

P-values in brackets

Table 5: Correlations between coffee yield changes since 1992 and staple crop yield changes since 1992

	coffee	**maize**	**cassava**	**bananas**
maize	-0.164 (0.414)			
cassava	0.154 (0.443)	**0.408** **(0.017)**		
bananas	-0.007 (0.971)	0.166 (0.348)	**0.390** **(0.025)**	
millet	0.063 (0.761)	0.640 (0.000)	0.187 (0.281)	-0.107 (0.553)

p-values in brackets

5.20 Econometric estimation of the community diversification used to testing the working hypothesis

In order to test the working hypothesis on whether community diversification drives wealth gap between poor and rich coffee communities, I run a levels OLS regression of the diversification equation (where diversification is proxied by the average share of non-agricultural income in the community) in the year 2000 using the 1992 community wealth variable as a regressor . I carry out hypothesis tests on the t-value of the coefficient on the lagged community wealth variable. The estimated diversification equation is shown below

Diversification equation

$$sh\_non\_agric = \beta_0 + \beta_1 wealth_{it-1} + \beta_2 region + \beta_3 rur\_urb_i + \beta_4 \log Dist + \beta_5 Credit + \beta_6 wages + \beta_7 Mkts + \beta_8 Popnhh + \varepsilon_i \quad (1)$$

The hypothesis to be tested is

$$H_0 : \beta_{wealth_{t-1}} = 0 \text{ against } H_1 : \beta_{wealth_{t-1}} > 0$$

This is the hypothesis that diversification increases with wealth and therefore may drive a gap between poor and relatively wealthier communities over time . From the results in able 6 below, the t-value of the diversification variable is -1.45 while the 5% critical value is 1.65. The t-value is less than the critical value so we fail to reject the null hypothesis. Therefore, there is no evidence that increased diversification at community level favour wealthier communities over time.

Table 6a: An OLS estimation of 1999 community diversification using 1992 community wealth

Diversification(Share of Non-agric income in 1999)	Coef.	Std. Err.	t-values	P-values
Log of community wealth in 1992	-0.015	0.010	-1.46	0.145
Regional dummies				
North (regional dummy)	0.021	0.034	0.62	0.535
East(regional dummy)	**-0.104**	0.025	**-4.14**	**0.000**
West(regional dummy)	**0.065**	0.026	2.52	**0.012**
Community attributes (Rural=0 Urban=1)	**-0.239**	0.034	**-6.94**	**0.000**
Log of distance from district center	**0.053**	0.010	**5.36**	**0.000**
Community Credit access(1999)	**0.037**	0.013	2.92	0.004
Log of non-agric.wages1999	**-0.042**	0.022	-1.95	0.052
Coffee market availability in community				
Some days	**0.104**	0.042	**2.48**	**0.014**
All days	-0.022	0.032	-0.68	0.497
Coffee Producers in community 1999				
Few	-0.008	0.041	-0.19	0.851
About half	0.011	0.037	0.3	0.768
Many	*0.061*	0.034	*1.77*	*0.078*
All	*-0.094*	0.055	*-1.69*	*0.092*
Log of community population (households)	**0.031**	0.014	2.28	**0.023**
_cons	0.718	0.223	3.21	0.001
Number of observations	269			
R-squared	0.48			
Root mean square error	0.14425			

Discussion of the OLS diversification estimates in table 6

Although community wealth shows no significant effect on diversification, the sign on its coefficient is negative meaning that poorer coffee producing communities are more diversified and vice versa. This indicates the importance of diversification as a risk coping mechanism at community level. Results show that there are significant regional differences in diversification patterns among coffee-producing in Uganda. Compared to the central region, communities in the eastern region of the country are significantly less diversified while those in the western region are significantly more diversified. In addition, urban communities are significantly less diversified than rural communities.

Since poverty is more prevalent in the rural areas, it is plausible that rural coffee communities diversify into many non-agricultural activities to cope with coffee price risk. .

As expected coffee producing communities in which credit is readily accessible are significantly more diversified than those with lack of credit access. This shows the importance of access to credit in exploiting income opportunities off-farm. Availability of coffee markets shows a significant tendency towards specialisation that diversification. Relative to communities with no coffee markets, coffee-producing communities in which markets are available in some days are significantly more diversified. On the other hand communities in which coffee markets are readily available, the sign on the diversification coefficient is negative although the coefficient is not significant. Community population size in terms of the number of households in the community significantly increases diversification away from agriculture. This may be is result of increased population pressure on land which reduces marginal returns on labour employed in farming. The positive effect on diversification can also be explained by the increased in demand for other goods and services created as community population grows.

5.22 Examining the effect of past diversification on current coffee producer behaviour

Table 6b: Estimating the effect of period 1 diversification on period 2 coffee producer behaviour

Proportion of coffee producers in community	**Coef.**	**Std. Err.**	**P>t**	Coef.	Robust Std. Err.	P>t
Share non-agric income 1992	-0.036	0.0953	0.703	-0.03642	0.080733	0.652
Central	0.0629	0.075	0.402	0.062913	0.080005	0.432
East	0.021	0.0532	0.693	0.021039	0.034838	0.546
West	0.0107	0.0504	0.832	0.010726	0.031877	0.737
Rural -urban area	-0.121	0.0506	**0.017**	-0.12134	0.041821	**0.004**
Log distance from capital city	-0.041	0.0289	0.153	-0.04136	0.034485	0.232
Log of Community HH population	0.003	0.0217	0.888	0.003048	0.01655	0.854
Availability of cultivable land	0.017	0.0322	0.599	0.016956	0.031397	0.59
Maize production dummies						
Few	-0.098	0.0396	**0.014**	-0.0976	0.038406	**0.012**
About half	-0.168	0.0584	**0.004**	-0.16757	0.0547	**0.002**
Many	-0.153	0.075	**0.042**	-0.15304	0.057127	**0.008**
About all	-0.231	0.0935	**0.014**	-0.2314	0.080446	**0.004**
Coffee Market dummies						
Available some days	0.324	0.0539	**0**	0.324015	0.057578	**0**
Available all days	0.493	0.0353	**0**	0.49302	0.040823	**0**
Agricultural production constraints						
Crop diseases	0.0653	0.0365	0.075	0.065311	0.034718	0.061
Land shortage	0.1064	0.0465	**0.023**	0.106377	0.050796	**0.037**
Poor soil fertility	-0.113	0.0611	0.065	-0.11342	0.078867	0.152
Credit access	0.0462	0.0611	0.45	0.046154	0.076163	0.545
Log of wages	0.0618	0.0341	0.072	0.061754	0.038338	0.109
_cons	-0.02	0.3332	0.952	-0.02018	0.325763	0.951

Test for goodness of fit: R-squared 0.6

The Breusch-Pagan test for heteroskedasticity: Ho: Constant variance chi2(1) = 15.79. Prob > chi2 = 0.0001. This significant implying that heteroskedasticity is a problem I therefore re-estimate using robust standard errors.

Although not significant period 1 community diversification in 1992 shows a negative effect on the proportion of coffee producers in the community. The hypothesis test of diversification increasing coffee production is as follows;

$H_0 : \beta_{diversification} = 0 \; against \; H_1 : \beta_{diversification} > 0$. The critical value c, is 1.65 and the t-value of 1992 diversification is -0.38 which far less than the critical value so we fail to reject the null hypothesis. Therefore, there is no sufficient evidence in that past income diversification patterns have an effect on present coffee producer behaviour in coffee producing communities.

5.21 Econometric estimation of Coffee Producer behaviour

Due to the limitations of the cross-section data, I now exploit the panel structure of the data to analyse the behaviour of coffee producers over time. Coffee producer behaviour is such that producers decide when to actively take care of their coffee trees for purposes of harvesting and this mainly depends on the seasonal prices and availability of coffee markets. This involves pruning, weeding and ploughing their fields in preparation for harvesting seasons. In bad price periods, some coffee farmers momentarily abandon their fields altogether (Hill, 2006). Since coffee is perennial crop that takes over three years to mature, it cannot be planted every season. As indicated in theoretical framework, income diversification and the proportion of coffee farmers in communities are jointly determined and are decisions taken within households. Coffee producer behaviour is analysed using a range of panel data techniques which allow for correlation between community effects and explanatory variables while controlling for endogeneity of some explanatory variables.

Four panel data models used to determine the effect of diversification on coffee producer behaviour while controlling for other factors These include the GLS random effects (GLS-RE) estimator, the Fixed Effects (FE) estimator , the IV-Random Effects (IV-RE) estimator the Hausman and Taylor (1981) (HT) estimator. These methods differ in the way they treat both community fixed effects and endogeneity in explanatory variables.

a) GLS-RE does not allow for correlation between explanatory variables and community fixed effects and therefore ignores the community fixed effects implying that it may give inconsistent estimates. However, in the absence of such correlation it will be efficient.

b) The IV-RE estimator also ignores community fixed effects but controls for endogeneity of the non-agricultural income variable in the producer behaviour equation. Access to credit and the log of non-agricultural wages (derived from the diversification equation) are used as instruments for non-agricultural income in the producer behaviour estimation.

c) The FE estimator allows for correlation between community specific effects and explanatory variables, therefore controlling for unobserved community heterogeneity and giving consistent estimates. However, the consistent estimates are obtained at a cost because time-invariant regressors are lost in the estimation resulting in a possible loss of efficiency in the estimation. If either GLS-RE or IV-RE is consistent, it will give more efficient estimates.

d) The Hausman-Taylor(HT) estimator is intermediate between the GLS-RE and FE estimators .It fits panel-data random-effects models in which some of the covariates are correlated with the unobserved individual-level random effect. The estimator, originally proposed by Hausman & Taylor (1981)), falls in the class of instrumental variables estimators. However, although both the IV-RE and the HT estimators use instrumental variables, they are designed for different problems. The IV-RE estimator assumes that a specified subset of the explanatory variables in the model

is correlated with the idiosyncratic error e_{it}. In contrast, the HT estimator assumes that some of the explanatory variables are correlated with the individual-level random-effects, u_i, but that none of the explanatory variables are correlated with the idiosyncratic error e_{it}. (Baltagi, 2008. pp 133). By allowing for correlation between some variables while controlling for endogeneity, the Hausman Taylor model achieves on both consistency and efficiency of the estimates.

A further intermediate estimator is the Amemiya-MaCurdy (1985) estimator which uses extra instruments to gain efficiency at the cost of additional assumptions on the data-generating process. However, this estimator may only be specified for samples containing balanced panels which must also have a common initial time period. Three subsets of explanatory variables that are specified include;

i) endogenous variables (which may be both time-invariant or time varying) are specified and these are the explanatory variables that are assumed to be correlated with the unobserved random effect,
ii) time-invariant independent variables
iii) time -varying independent variables.

5.23 Examining the effects of diversification regressors on coffee producer behaviour

Estimation strategy

Here, I regress the variables that influence community diversification on coffee producer behaviour to determine their impact on crop portfolios over time. My aim is to

determine whether the variables that influence community diversification also influence crop portfolios over time. I estimate the coffee producer behaviour using the GLS random effects, the Fixed effects and the Hausman–Taylor specifications elaborated in the previous section. I then carry out Hausman tests to compare the estimates from different procedures in order to determine which estimation procedure suits the data best.

The estimated Producer equation is

$$pcoffprod_{it} = \gamma_0 + \gamma_1 diverseinc_{it} + \gamma_2 landavail_{it} + \gamma_3 Ext_{it} + \gamma_4 maizeprod_{it} + \gamma_5 Agwages_{it} + \gamma_6 Nonagwages_{it} + \gamma_7 Dist_i + \gamma_8 Mkts_i + \gamma_9 coffconst_i + \gamma_{10} Location_i + \gamma_{11} Year99 + \nu_{it}$$

Taking first differences yields (4)

$$\Delta coffprod = \gamma_1 \Delta diverseinc + \gamma_2 \Delta landavail + \gamma_3 \Delta Ext + \gamma_4 \Delta maizeprod + \gamma_5 \Delta Agwages + \gamma_6 \Delta Nonagwages + \gamma_{11} + v_{it}$$

where

$diverseinc_{it}$ = average share of non-agricultural income in community

$landavail_{it}$ = availability of land in community level

Ext_{it} = Extension access in community,

Maizeprod= Maize producer dummies in community

Agwages= agricultural wages

Nonagwages= Non agricultural wages

hhsize/land= labour-land ratios

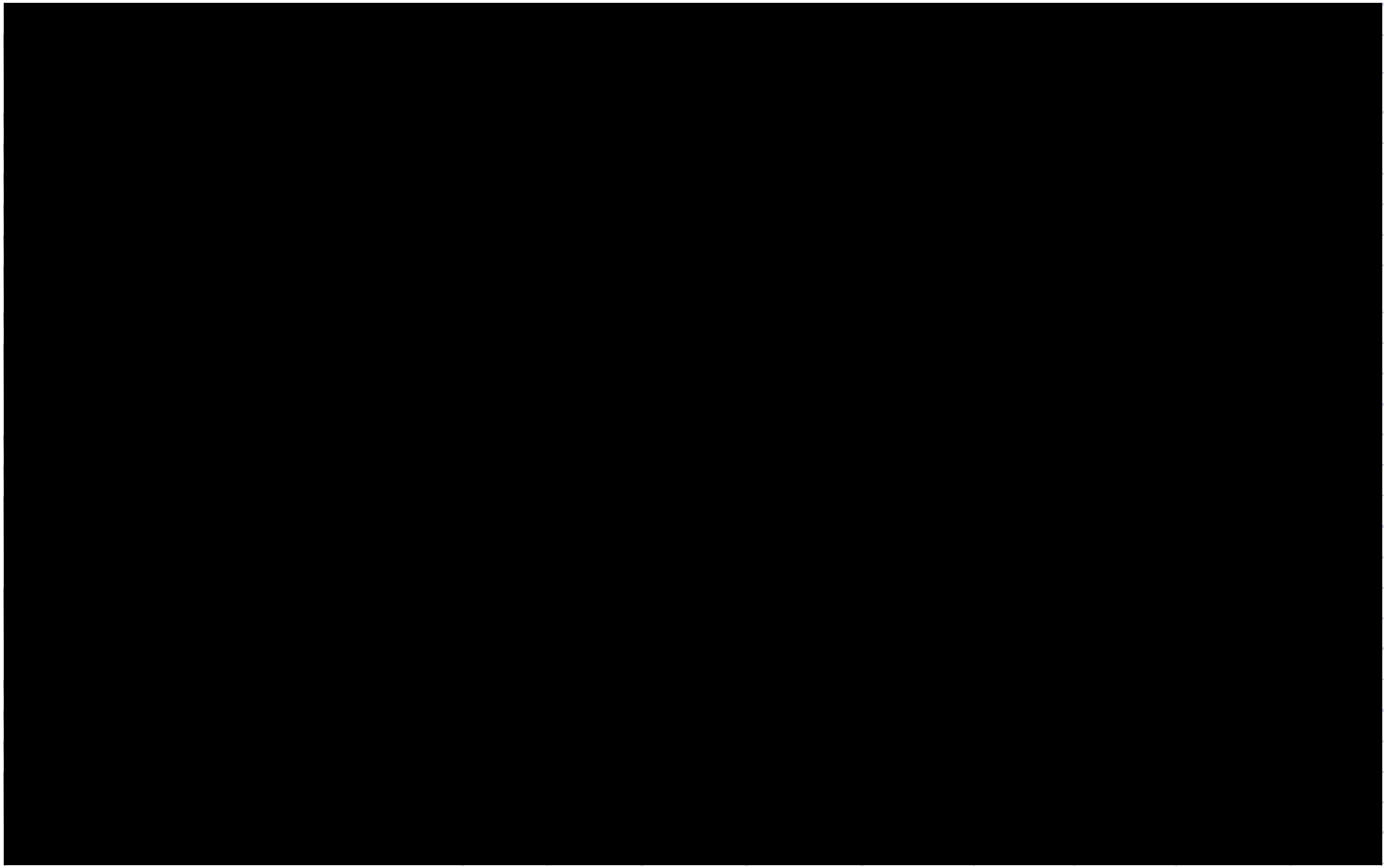
landavail-Availability of cultivation land allocation policy in community

Region= regional dummies

Dist= Distance from capital city

Devpt= community development stage

Pcoffprod= proportion of coffee producers in community



Discussion of the Coffee Producer behaviour estimates over time

As expected, urban areas have significantly lower proportions of coffee producers than urban areas because most of the coffee is produced in rural areas. The capital city (Kampala) is the main collection and export centre for Ugandan coffee. A significant negative coefficient on the log of distance from the capital (Kampala) indicates that the proportion of coffee producers in Ugandan communities becomes significantly reduced the further away the community is from Kampala due to increased transport costs. As transport and access costs increase, traders find it less profitable to purchase and collect coffee from distant and less accessible communities thus reducing the proportions of producers who actively maintain their coffee trees in preparation for the harvest periods. It is important to note that the changes in the proportions of coffee producers are mainly due to changes in the number of farmers actively allocating labour to maintain existing coffee trees for subsequent harvest periods rather than new entrants into coffee farming. This is because coffee is a perennial crop which takes between 2-3 years to the first harvest after planting meaning that supply is price inelastic. Farmers tend to allocate more labour to maintain their coffee trees when prices are good than when prices are low.

According to the fixed effects simation,the proportion of coffee producers is significantly higher in communities where land is made available or allocated to households for cultivation purposes than in communities where no land is available (or allocated) for cultivation purposes. This result indicates The positive benefits of active arable land allocation policies on production in commodity markets.

Relative to communities with very maize production, communities with high maize production have a significantly lower proportions of active coffee farmers. In fact the coefficients on the proportions of coffee producers become larger and p-values much more significant in higher maize producing communities. This result is robust across the GLS specification and is an indication of changes in land use patterns with maize, a non-traditional agricultural cash crop substituting for coffee, a traditional cash crop and crop over time.

Relative to other constraints to coffee production raised by farmers, coffee markets, coffee diseases, land availability and soil fertility significantly constrain coffee production as shown by estimation results in table. Though not significant presence of credit constraints shows a robust negative coefficient across the GLS and Hausman and Taylor specifications. This observation further reinforces the effects of credit constraints on coffee marketing behaviour discussed in chapter three .

Among the constraints to coffee farming reported by farmers coffee diseases, land shortages are significant further reinforcing the substitution argument Though not significant, credit constraints and declines in soil fertility reduce the proportions of coffee producers in Uganda communities over time.

Specification issues

Table: 8 Hausman Specification Tests

	FE versus GLS-Random effects	FE versus Hausman-Taylor	Hausman taylor Vs GLS-RE
Hausman test	$\chi^2(6) = 8.1$ p-value =0.2312	$\chi^2(8) = 0.53$ p-value= 0.9975	$\chi^2(8) = 9.9$ p-value= 0.9351

The results are fairly robust across the different panel specifications(i.e. GLS random effects, hausman taylor and fixed effects) which used to estimate coffee producer behaviour in the 1992/1999 Ugandan community panel. In all cases, the p-values are not significant at the 5% level implying that there are no systematic differences between the fixed effects and other specifications which do not allow for correlation between community fixed effect and other regressors.

Although the fixed effects model which allows for the community–specific variables to be correlated with other explanatory variables in the producer equation may fit the data better, it comes at a cost of significant loss of information as time-invriant variables are lost in the fixed effects estimation.The insignificant Hausman test between the fixed estimates and Hausman-Taylor estimates implies that there is no systematic difference between other sets of estimates which are consistent but less efficient. Therefore results from the GLS_random effects and the Hausman taylor specifications are valid.

5.50 CONCLUSIONS AND POLICY IMPLICATIONS

Significant regional difference in diversification: less in east and noth, more in west vs central Credit access + Access to trading enters+ population size+ non-agrc wages -

5.51 Income diversification:

Diversification at community level is determined by a combination of both pull and push factors. A significant pull factor is access to credit in communities which enables households to take on higher income opportunities outside griculture. Significant push factors include poor access to trading centers and this pushes household into diversification (self provision of other goods and services) and community population size. As the number of households in communities rise, the high population pressure on arable land results into diminishing marginal returns to farm labour thus pushing households into non-farm income activities

factors include wealth and changes in the production of major commodity markets like coffee. Given that wealth shows a negative but insignificant effect on the share of non-agricultural incomes at the community level, it is likely that diversification may perpetuate aggregate poverty in communities as poor communities diversify into many low returnactivities.. The negative wealth effect at community level in line with the dominance of diversification in terms of an increase in number of income sources by poor communities as opposed to the increase in the portfolio of activities (which increases the share of non-agricultural incomes as observed in chapter 4). However this result is not very conclusive because dversification patterns at community level may cloud diversification patterns at household level.. Household diversification analysis in chapter 4 gives a more definitive

view. Compared to rural communities, urban communities show less diversification at community level. You would expect urban communities to have a higher share of income derived from non-agricultural sources but it is likell that desperation-led diversification in rural; communities dominates resulting in this suprising result at community level

Conclusions and policy implications on income diversification are based on possible gains in poverty reduction and gains from increased agricultural production as deduced from the diversification estimates.

a) Poverty reduction: Since share of non-agricultural reduce increase as wealth increases, rural poverty policy in Uganda should aim at helping poor communities diversify into activities which can generate economies of scope to prevent poverty perpetuation that may result from undertaking several low return activities. Communities can be zoned depending on their comparative advantages in a way that generates backward and forward linkages with neighbouring zones and urban centers.

From the study findings, development policy should focus on improving the factors that enhance opportunity-led income diversification while minimizing the constraints that drive desperation led diversification. This will help to reduce dependence on a few traditional agricultural exports which face both price and output risk.

Since access to credit especially among rural communities enhances non-agricultural incomes through providing working capital, greater financial penetration in rural communities with raw or untapped opportunities is likely to have greater returns on poverty reduction than in urban communities as shown by findings in the diversification estimation.

b) Gains from agricultural markets: Given that the avaialability of markets for traditional cash crops likecoffee producers significantly increases non-agricultural incomes, there are potential poverty reduction gains to be tapped from increased agricultural productivity and market access for poor communities in two ways. First, surplus income from the sale of agricultural commodities can generate capital to invest in the non-agricultural sector thus dealing with credit constraints faced in communities. Secondly improved agricultural productivity leads to a reduction in food prices which form a large portion of low income workers and this will result in reductions in non-agricultural wages over time, a variable that significantly reduces no-agricultural incomes in the diversification equation. This calls for concerted efforts with policies aimed at increasing land productivity through the use of improved crop varieties, and on-farm mechanization.

5.52 Coffee producer behaviour

Conclusions and policy recommendations for coffee producer behaviour are based on improving community access (infrastructure)and dealing with constraints to coffee production.

a) Community access and infrastructure: Given that the distance to the capital city is one of the significant impediments to the proportion of coffee producers within communities, improving community access through road and communication infrastructure will enhance coffee production.

b) Promoting opportunities for profitable income diversification increases the proportion of farmers that actively maintain their coffee farms since non-agricultural incomes can readily be used to hire labour to maintain coffee trees.

c) The significant constraints to coffee production over the 8-year study period include coffee diseases, land availability, credit access and declines in soil fertility. Therefore long term agricultural commodity policy should aim at increasing access to markets, fighting crop diseases, streamlining land use policy, credit access and improving soil fertility.

Appendix

Table 9: Cross tabulation between coffee production variables (yield and producer changes) and coffee market availability

Market availability	**Coffee Producers changein 1992**					
	Decreased a lot	Decreased a little	Remained same	Increased a little	Increased a lot	Total
Unavailable						
#	4	24	61	39	3	131
	3.05	18.32	**46.56**	29.77	2.29	100
	10.53	20.51	41.78	36.11	6.82	28.92
Some days						
#	11	15	17	8	3	54
row%	20.37	27.78	**31.48**	14.81	5.56	100
column%	28.95	12.82	11.64	7.41	6.82	11.92
All days #	23	78	68	61	38	268
row%	8.58	**29.1**	25.37	22.76	14.18	100
column%	60.53	66.67	46.58	56.48	86.36	59.16
Total #	38	117	146	108	44	453
row%	8.39	25.83	32.23	23.84	9.71	100
column%	100	100	100	100	100	100

Pearson χ^2 (8) = 47.83 p-value 0.000
Cramér's V = 0.2298

Table 10: Cross tabulation between coffee yield changes and coffee market availability

	Yield change since 1992					
Market availability	Decreased a little	Decreased a lot	Remained same	Increased a little	Increased a lot	Total
Unavailable						
#	6	33	60	28	2	129
row%	4.65	25.58	**46.51**	21.71	1.55	100
cloumn%	7.5	20	48.39	43.75	22.22	29.19
Some days #	5	20	12	6	2	45
row%	11.11	**44.44**	26.67	13.33	4.44	100
cloumn%	6.25	12.12	9.68	9.38	22.22	10.18
All days #	69	112	52	30	5	268
row%	25.75	**41.79**	19.4	11.19	1.87	100
cloumn%	86.25	67.88	41.94	46.88	55.56	60.63
Total #	80	165	124	64	9	442
row%	18.1	**37.33**	28.05	14.48	2.04	100
cloumn%	100	100	100	100	100	100

Pearson χ^2 (8) = 60.58 p-value 0.000

Cramér's V = 0.2618

Table 11: Cross tabulation between coffee production variables and main reasons for change in production

Primary reasons for yield change.	**Yield change since 1992**					
	Decreased a lot	Decreased a little	Remained same	Increased a little	Increased a lot	Total
Change in input use #	0	0	0	19	5	24
row%	0	0	0	**79.17**	**20.83**	100
column%	0	0	0	22.09	12.5	7.36
Diseases #	30	99	31	34	22	216
row%	13.89	**45.83**	14.35	15.74	10.19	100
column%	76.92	83.9	72.09	39.53	55	66.26
Reduction in fallow #	2	11	1	4	2	20
row%	10	55	5	20	10	100
column%	5.13	9.32	2.33	4.65	5	6.13
Labour use changes #	0	0	0	6	0	6
row%	0	0	0	100	0	100
column%	0	0	0	6.98	0	1.84
New technology #	0	0	0	3	2	5
row%	0	0	0	60	40	100
column%	0	0	0	3.49	5	1.53
Losses due to animals #	1	0	0	0	0	1
row%	100	0	0	0	0	100
column%	2.56	0	0	0	0	0.31
Weather problems #	6	6	10	0	1	23
row%	**26.09**	**26.09**	**43.48**	0	4.35	100
column%	15.38	5.08	23.26	0	2.5	7.06
Others #	0	2	1	20	8	31
row%	0	6.45	3.23	64.52	25.81	100
column%	0	1.69	2.33	23.26	20	9.51
Total #	39	118	43	86	40	326
row%	11.96	36.2	13.19	26.38	12.27	100
column%	100	100	100	100	100	100

Pearson χ^2 (28) = 156.91 p-value 0.000

Cramér's V = 0.3469

Table 12: Cross tabulation between coffee production variables and changes in availability of cultivable land.

Land availability 1999	Change in Producer number since 199292					
	Decreased a lot a lot	Decreased a little	Remained same	Increased a little	Increased a lot	Total
Not available#	17	62	89	79	30	277
Rowpercentages	6.14	22.38	32.13	28.52	10.83	100
Column percentages	42.5	54.39	68.46	79.8	65.22	64.57
Available#	16	38	22	17	13	106
Row percenatge	15.09	35.85	20.75	16.04	12.26	100
Column percentage	40	33.33	16.92	17.17	28.26	24.71
Type not practised#	6	13	18	2	2	41
Row percentage	14.63	31.71	43.9	4.88	4.88	100
Column percentage	15	11.4	13.85	2.02	4.35	9.56
Type not permitted#	1	1	1	1	1	5
Row percentage	20	20	20	20	20	100
Column percentage	2.5	0.88	0.77	1.01	2.17	1.17
Total	40	114	130	99	46	429
Row percentage	9.32	26.57	30.3	23.08	10.72	100
Column percentage	100	100	100	100	100	100

Table 13; Cross tabulation between coffee production variables and food security

Proportion of food buying farmers 1999	Yield changes since 1992					
	Decreased a lot	Decreased a little	Remained same	Increased a little	Increased a lot	Total
None #	16	21	16	10	0	63
Row %	25.4	33.33	25.4	15.87	0	100
Column %	19.75	13.91	14.04	16.39	0	15.11
Few #	15	62	52	29	5	163
Row %	9.2	38.04	31.9	17.79	3.07	100
Column %	18.52	41.06	45.61	47.54	50	39.09
About half #	11	16	6	3	2	38
Row %	28.95	42.11	15.79	7.89	5.26	100
Column %	13.58	10.6	5.26	4.92	20	9.11
Many #	26	37	29	18	2	112
Row %	23.21	33.04	25.89	16.07	1.79	100
Column %	32.1	24.5	25.44	29.51	20	26.86
All #	13	15	11	1	1	41
Row %	31.71	36.59	26.83	2.44	2.44	100
Column %	16.05	9.93	9.65	1.64	10	9.83
Total	81	151	114	61	10	417
Row %	19.42	36.21	27.34	14.63	2.4	100
Column %	100	100	100	100	100	100

Pearson χ^2 (16) = 29.9306 p-value 0.018

Cramér's V = 0.134

CHAPTER 6

6.0 CONCLUSIONS

In this thesis, I have analyzed the following issues;

1) In Chapter 3, I have undertaken a comprehensive analysis of the complex marketing strategies that different households adopt in the Ugandan coffee supply chain, and examined the implications for the incomes of coffee-producing households.

2) In chapter 4, I have analyzed the different dimensions of household diversification and determined their effects on poverty incidence (headcount), poverty depth and poverty transitions within Ugandan households. Here, I have done a further analysis of the differences in entry, survival and exits by households into and out of non-crop enterprises over time and the consequences on household poverty incidence and transitions. I have also tested both the push and pull diversification hypotheses and examined whether a causal link exists between poverty and diversification. I find no evidence of the existence of this causal link.

3) In chapter 5, I have analyzed diversification patterns at community level and determined how they have influenced behaviour in agricultural commodity markets in terms producer changes and the commodity mix between traditional cash crops (like coffee) and newly marketable staple food crops (like maize) over time.

Methods:

I have used the following methods;

In chapter 3, I adopt an empirical econometric methodology to analyze cross-sectional survey data for the coffee marketing study. Here, I posit a model that sets out the different modes in which coffee is sold to the market such that the modes not only include selling point (i.e. whether farm gate, market or huller or combinations each of the following) but also the form in which the coffee is sold (i.e. whether it's sold as raw cherries, dried cherries, processed cherries or a combination of any of these) during the season. I analyze the determinants to the sequence of decisions that are taken after harvesting coffee in the marketing chain include the decision to sell processed coffee at hullers, the decision to sell dried coffee beans in the market or farm gate and the decision to sell raw coffee cherries at the farm gate. I then run regressions on discounted unit values to determine the loss in income per unit of coffee sold from the different sales modes relative to processed coffee sale at hullers.

For chapter 4, I use panel data techniques to study the effects of the different dimensions of household diversification on poverty incidence depth and transitions. Here I group panel households into mutually exclusive groups based on the different dimensions of diversification including the main income activity type, non-crop enterprise type, and the scope of the activity portfolios that household undertake. Other continuous variables that capture diversification include household share of non-agricultural income and the number of income sources at household level. I then analyze the determinants of the different diversification dimensions while controlling for regional, community and household variables. I then analyze the impact of diversification on outcome poverty variable like incidence, depth, severity and incidence.

In Chapter 5, I use panel data techniques to analyze income diversification at community level and its effects on conduct in commodity markets.

6.10 Conclusions

6.11 Conclusions from the Coffee marketing strategies (Chapter 3)

The general conclusion from the analysis in chapter 3 is that to improve seasonal coffee incomes in Uganda coffee marketing chain, it not only matters where you sell but also when and in what form you sell the coffee. From the analysis, I find that the differences in coffee revenues across households are not only due the sales location decisions but also the due to the sales mode and timing of coffee sales (patience). Fafchamps and Hill (2005) concentrate on only where the coffee is sold hence the title of their article i.e. *selling to the market or at the farm-gate*. I take a different approach that allows the calculation of the financial benefits of different household choices in the coffee marketing chain. This approach also highlights the benefits of increased household processing in the coffee value chain, and the effects of different sales outlets (i.e. market, farm-gate or huller) on unit values and subsequent seasonal coffee incomes.

In line with Fafchamps and Hill (2005), I find a significant negative relationship between household wealth and selling to the market implying that relatively wealthier farmers are less likely to sell to the market and more likely indulge in the convenience of the farm gate sale due to the high opportunity cost of their time if invested in other income generating activities.

I also find that despite quantity sold and wealth having a negative effect on selling to the market, the interaction term between wealth and quantity sold shows a significant positive effect on selling to the market. This is also in line with the proposition that wealthier

farmers are more likely to sell to the market as quantity sold increases provided that unit transport costs do not increase with quantity sold. (Fafchamps and Hill, 2005, pp720).

In contrast with Fafchamps' findings, an increase in the proportion of enrolled children in the household has a significant negative effect on the likelihood of selling to the market. This finding gives further evidence of the increased consumption and price risk resulting from raising inflation and food costs. Though ownership of a bicycle or a motorcycle does not show any significant effect on the decision to sell coffee in the market, it has a positive effect on market sales.

On the production side, I also conclude that coffee production among small holder farmers is still below the productive capacity and there is still potential to increase coffee production in Uganda given that land is not much of a constraining factor among farming households. Estimates from the production function in chapter 3 show that the full productive capacity at which marginal returns begin to diminish in the Uganda's coffee industry is 2 acres (about 1000 coffee trees) and yet the estimated average coffee field size from the data is 1.37 acres (about 270 trees) indicating the potential to produce more.

The originality to my work in this chapter is derived from the approach I take to calculate the financial benefits of different household choices in the coffee marketing. By comparison with previous studies, the marketing study in chapter 3 has captured a crucial but relatively under-researched aspect of the coffee supply chain: the impact of increasing heterogeneity in coffee sales mode and sales location decisions prior to and after harvesting on incomes. Most notably, the study has considered the impact of raw coffee sales on incomes, a phenomenon that has seldom been documented or discussed. The findings indicate that raw coffee sales appear to substitute for credit for farm households who face urgent family-

(education and health) related expenditure requirements. The implied annual interest rate on this means of obtaining funds is estimated at close to 100 per cent on an annual basis. In this study, I also combine econometric analysis with behavioural (experimental economics) techniques, specifically multiple price list methods to capture both farmer behavioural responses such risk attitudes and patience levels.

Policy implications: The insights gained from this study can be useful in designing and evaluating alternative policies to improve the functioning of the coffee supply chain. The findings show that there is substantial potential for Ugandan coffee farmers to substantially increase their revenues through better processing and marketing even if world coffee prices remain at low levels. Farmers appear to be constrained by lack of access to credit and this forces many of them to market coffee in ways which reduce total revenue. The bottom line is that commodity policy, at least so far as it regards the Ugandan coffee sector, should be more focused on credit and productivity than on prices.

6.12 Conclusions on diversification and poverty (Chapter 4)

i) At household level, income diversification achieved through increasing the number of income activities is desperation-led while that achieved through increasing the share of non-agricultural incomes and varying the portfolio of income activities is not desperation-led. Increasing the number of income activities in agriculture-related activities may potentially perpetuate poverty if households simply increased the number of income activities for safety reasons.

At the community level, I find that Uganda's diversification patterns over time are largely desperation-led rather profit-led. This is because most constraints to agricultural

production, such as credit access, market access, labour-to-land ratios and road access show significant positive impacts income diversification and yet household wealth does not (see chapter 5). This may potentially perpetuate poverty if households simply increased the number of income activities for safety reasons.

ii) The more varied the portfolio of activities the household was engaged in, the higher the share of income it derived from non-agricultural activities. This finding does not hold for the number of household income sources.

It follows that the potential gains in welfare and poverty reduction from household diversification in Uganda over time may result from variation in the activity portfolios or enterprise types undertaken by households as opposed to increasing the number of activities in the same sector.

iii) Despite widespread poverty within the mainly rural agricultural households, the findings in table 3 show that long term poverty rates within the mainly wage-dependent households were no better. Compared to self-employed households in the agricultural and non-agricultural sectors, both poverty incidence and poverty gaps were higher among wage-dependent households over time. Despite government efforts to create more employment opportunities by attracting foreign investors, little emphasis has been placed on the quality of jobs created, leading to a growing size of working-poor households. Self employed non-agricultural households saw a 50% decline in poverty prevalence from 20% to 10% and a bigger decline in poverty gap (i.e. from 6.2% to 2.7%), when compared to wage-dependant households whose poverty gap increased over time.

iv) Poverty analysis results show that household size, income diversification, the number of primary schools, the proportion of households buying food in the lean period, per capita households land, household wealth and credit access as the major variables affecting household welfare and poverty over time. These finding are in line with poverty analysis work on Ugandan households done by Okidi and Denninger (2001). My findings are also in line with the findings from the combined qualitative and quantitative poverty studies done by Lawson et al (2005) on the 1992/1999 panel of Ugandan households.

The originality of this thesis in the analysis of diversification and poverty is that I capture the determinants of the different dimensions of household diversification and determine their effects on poverty incidence, depth and transitions. Most previous studies attempt to capture the share of non-agricultural income as a measure of diversification. In addition I have undertaken a further analysis of the factors that affect entry, survival and exits by households into and out of non-crop enterprises over time..

Policy implications:

a) Private-public partnerships to encourage local enterprises in the non-formal sector to thrive can potentially compliment formal wage labour markets in improving the quality of employment and subsequently reducing poverty over time. Thus, in addition to improving agricultural productivity to lower food prices for urban workers, safety net programs must include for the working-poor households in urban and semi-urban areas who may be worse-off than the poor in the agricultural sector.

b) Diversification policy should therefore aim at increasing household skills and assets in order to benefit from economies of scope (complementarities) between different portfolios of farm and non-farm activities while simultaneously insuring against income risk.

c) Poverty targeting should not only be rural and agricultural biased but should also target both urban poor workers who might be equally vulnerable or even worse off.

d) Therefore long term poverty reduction efforts and policies in Uganda should aim at;

i) Controlling population growth through widespread implementation of reproductive health programs and family planning

ii) Supporting households to undertake diversified portfolios of activities which benefit from economies of scope (complementarities) and confer a dynamic comparative advantage rather activities that exhibit decreasing marginal returns. Improving agricultural productivity also helps to boost diversification through a reduction in non –agricultural wages as food prices fall.

iii) Increasing not only access to education services but also improving the quality of education to improve awareness and create income opportunities in future.

iv) Improving food security through programs aimed at increasing agricultural productivity especially in rural areas. This may include the use of high crop yielding varieties to increase output per unit of land or measures to improve soil fertility as population pressure on arable land increases over time

v) Implementing proper land policies to improve land use efficiency through secure land-use rights for poor people, and land titling which provide collateral, thus increasing credit access to help poor households further diversify their incomes.

As shown by the break down analysis of poverty, there is need to tailor poverty policy in order to suit different the needs of different regions and sectors in the country, and improve the targeting of poverty interventions and program. This will greatly increase the returns to poverty reduction from these interventions.

6.13 Conclusions on community diversification and Conduct in commodity markets (Chapter 5)

Conclusions and policy implications on income diversification will be based on possibles gains in poverty reduction and gains from increased agricultural production as deduced from the diversification estimates.

a) Gains in poverty reduction: Since non-agricultural incomes significantly increase as wealth increases, income and activity diversification provides an opportunity to increase incomes and reduce poverty in an African continent challenged with climate change, a rapidly growing population and rising food prices. From the study findings, development policy should focus on improving the factors that enhance income diversification while minimizing the variables that constrain non-agricultural incomes. This will help to reduce dependence on a few traditional agricultural exports which face both price and output risk. Since access to credit especially among rural communities enhances non-agricultural incomes by providing capital, greater financial penetration in rural communities with raw or untapped

opportunities is likely to have greater returns on poverty reduction than in urban and semi urban communities as shown by results in the diversification equation.

b) Gains from agricultural productivity: Given that the proportion of coffee producers significantly increases non-agricultural incomes, there are gains to be tapped from increased agricultural productivity in two ways. First, surplus income from the sale of agricultural commodities can generate capital to invest in the non agricultural sector thus dealing with credit constraints faced in communities. Secondly improved agricultural productivity leads to a reduction in food prices which form a large portion of low income workers and this will result in reductions in non-agricultural wages over time, a variable that significantly reduces no-agricultural incomes in the diversification equation. This calls for concerted efforts with policies aimed at increasing land productivity through the use of improved crop varieties, and on farm mechanization.

c) Coffee producer behaviour

Conclusions and policy recommendations for coffee producer behaviour are based on improving community access (infrastructure), increasing income diversification and dealing with constraints to coffee production.

a) Community access and infrastructure; Given that the distance to the capital city is one of the significant impediments to the proportion of coffee producers within communities, improving community access through road and communication infrastructure will enhance coffee production

b) Promoting opportunities for income diversification increases the proportion of farmers that actively maintain their coffee farms since non-agricultural incomes can readily be used to hire labour to maintain coffee trees

c) The significant constraints to coffee production over the 8 year study period include availability of coffee markets, coffee diseases, land availability, credit access and declines in soil fertility. Therefore long term agricultural commodity policy should aim at increasing access to markets, fighting crop diseases, streamlining land use policy, credit access and improving soil fertility.

6.20 Aspects for further research

The limitations to the studies carried out in this thesis include the lack of qualitative data on poverty which would be combined with survey panel data in order to study the broader dimensions of poverty .In addition frequent observations of economic growth in terms of GDP growth in LDCs have not been accompanied by sufficient reduction in poverty and sufficient creation of non- farm jobs. My future research will study the mechanisms by which economic growth translates into poverty reduction and job creation over time using mainly administrative data. i.e. why do we see differential regional poverty reduction and growth in farm jobs in countries where economic growth has been sustained.

Over 20% of the LDC population will be engaged in the non-formal sector given the limited capacity of the formal and private sector in generating enough jobs. Thus, my further research will entail understanding constraints and the determinants to profitability and productivity of the smallest household enterprises and determinants to entry, exit and survival. This will be an aspect of my future research. In addition issues of vulnerability i.e. the probability of falling into poverty for non poor households have not been addressed in poverty analysis and they also need to be researched further. The lack of panel data in the marketing studies is a

limitation to studying changes in commodity marketing patterns over time and this is also be a component of my future research.

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