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**ESSAYS ON THE EFFECTS OF COFFEE MARKET
REFORMS, SUPPLY CHAINS, AND INCOME
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Abdoul Karim Murekezi

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ESSAYS ON THE EFFECTS OF COFFEE MARKET REFORMS, SUPPLY CHAINS, AND INCOME IMPROVEMENT IN RWANDA

By

Abdoul Karim Murekezi

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ABSTRACT

ESSAYS ON THE EFFECTS OF COFFEE MARKET REFORMS, SUPPLY CHAINS, AND INCOME IMPROVEMENT IN RWANDA

By

Abdoul Karim Murekezi

This dissertation assesses the effects of policy reforms on farmers. These reforms were started by the Government of Rwanda (GOR) in the early 2000s. The first essay is based on a national agricultural household cross sectional survey of 498 coffee growers and 4,376 non-coffee farmers. The first essay identifies determinants of rural household income in Rwanda and elucidates differences between farmers growing coffee and non-coffee farmers. Results from quantile regressions showed that growing a large number of staple crops was positively associated with household expenditures for both coffee growers and non-coffee farmers. Moreover, the results also found that increasing farm size per capita, off-farm income opportunities and formal wage were associated with increasing household income. Similarly, sales of livestock products, such as milk or eggs, as well as the production and sale of fruit contribute significantly to improving household income. The analysis also highlights the high return of education for both coffee and non-coffee growers.

The second essay of this dissertation determines the effects of coffee sector reforms on coffee-growing households. The effects of the reforms are represented in terms of the yearly household expenditures per adult equivalent, a proxy of income. This essay uses a representative panel data of 252 coffee households surveyed in 2001 and

2007. Using fixed effects model and the instrumental variable method, results show that coffee farmers benefited from the reforms by increasing their expenditures over time. In addition, the results show that coffee growers that sell to the new coffee cherry market benefited more from these reforms than farmers who sell to the traditional parchment market. These effects were, however, not statistically significant.

The third essay compares the effects of two organizational forms of coffee supply chains (cooperatives and private processors) on household income. It also assesses which supply chain has benefited coffee growers the most. This essay uses a reduced panel data of 148 coffee households that were derived from the panel data used in the second essay. Only farmers selling coffee cherries were retained in the analysis. Using the walking distance (in minutes) as an instrument for the choice of the supply chain, estimations from the instrumental variable method show that there is no indication that farmers benefited from selling cherries to processing cooperatives instead of selling to private processors. These findings provide important information that may assist the Rwandan Government, international funding and development agencies in assessing the impacts of coffee policies and in developing other policies or interventions that induce the poverty reduction of farmers.

ACKNOWLEDGEMENTS

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LIST OF ACRONYMS

ACDI-VOCA	Agriculture Cooperative Development International/Volunteers Overseas Cooperative Assistance
ADAR	Agribusiness Development Assistance
CIF	Cost, Insurance and Freight
COOPAC	Coopérative pour la promotion des Activités-Café
CWS	Coffee Washing Station
FLO	Fair-trade Labeling Organization
FOB	Free on Board price
GOR	Government of Rwanda
ICO	International Coffee Organization
IMF	International Monetary Fund
IOF	Investor-Owned Firms
MINICOFIN	Ministry of Finance and Economic Planning
MINAGRI	Ministry of Agriculture and Livestock
NGOs	Non-Governmental Organizations
NISR	National Institute of Statistics of Rwanda
OCIR	Rwandan Coffee Agency known in French as Office des Cultures Industrielles du Rwanda
OLS	Ordinary Least Squares
PEARL	Partnership in Enhancement Agriculture in Rwanda through Linkages
RWASHOSCA	Rwandan Small Holder Specialty Coffee Association
SCAA	Specialty Coffee American Association
SPREAD	Sustaining Partnerships to enhance Rural Enterprise and Agribusiness Development
USAID	United States Agency for International Development
WB	World Bank

CHAPTER 1. INTRODUCTION

1.1 Background and research context

Like many developing countries, Rwanda has gone through structural adjustment programs since the 1990s. These programs, advocated by the International Monetary Fund (IMF) and the World Bank (WB), aimed, among other things, to improve resource allocation, establish the basics for sustainable growth and poverty reduction, and to stabilize the economies of these countries (World Bank, 1997). During the same period, international coffee agreements put in place by the International Coffee Organization (ICO), to stabilize coffee prices were suspended. Their suspension coupled with the structural adjustment programs resulted in changes in domestic coffee policies in Rwanda and other countries that produce and export coffee (Baffes et al., 2005).

The suspension of the coffee agreements also resulted in oversupply of commodity coffee. International coffee prices plummeted and translated into low prices paid to farmers (You et al., 2003). Consequently, farmers responded to low coffee prices by decreasing coffee production and switching to other crops. A coffee census showed that the national share of coffee farmers decreased from 55% in 1991 to 30% in 2002 (Loveridge et al., 2003). Moreover, findings from the agricultural household survey of 1990 (Kangasniemi, 1998), showed that banana was the main cash crop for rural Rwandans and was used to buy staple crops in the market. However, banana production is no longer promoted by current agricultural policies. Current government policies promote cereal production at the expense of roots, tuber crops and bananas. One of the goals of this dissertation is to understand how farmers have responded to current agricultural policy. The dissertation makes an empirical contribution about factors driving poverty reduction among coffee and non-coffee growers.

Coffee remains one of Rwanda's most important official sources of foreign exchange and an important source of income among smallholder farmers (Schluter et al., 2001). In response to the coffee crisis, the GOR liberalized coffee marketing towards the end of 1990 and embarked on a policy of quality improvement. With the support of non-governmental organizations (NGOs) and international donors, the GOR introduced policy incentives that encouraged coffee cooperatives and independent entrepreneurs to invest in coffee processing and marketing. For instance, the GOR guaranteed 40% of the total investment and eliminated export taxes for all coffee produced through processing factories. Unlike during the pre-liberalization reforms, coffee cooperatives and independent investors can purchase coffee cherries from farmers and perform the processing in their factories.

However, despite a heavy investment in coffee processing, a large proportion of farmers still process coffee using traditional methods and still sell parchment coffee. The effects of these policies have not been assessed. This dissertation forms a new empirical contribution of the analysis of market reforms. The specific features of the Rwandan coffee sector will broaden the existing knowledge of how coffee sector reforms affected farmers. The anticipated results of the study are also important to agricultural policy in other export crop countries. Results may also assist the GOR in the liberalization of other export crops such as tea.

Coffee cooperatives and private investors responded positively to the policy changes and the associated incentives by building new processing plants. Starting with only two washing stations operating in 2001, the number of coffee processing plants has jumped to more than a hundred washing stations in 2007 (SPREAD, 2007). The

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liberalization of the coffee marketing has resulted in an increase of private investment in coffee processing. Coffee processors have operated, however, in conditions of limited coffee production that resulted in an overcapacity of the coffee cherry processing. Policy reforms combined with insufficient raw coffee exacerbated domestic competition in the coffee cherry market.

These features of the Rwandan coffee cherry market form a special case which can broaden the existing knowledge of how different supply chain arrangements operate in a developing country context. As coffee farmers sell cherries to the two organizational forms, comparing the effects of the two channels on farmers' income is also important for economic development policy. The development community, aid agencies, and governments are currently expecting hard evidence on the impact of interventions.

1.2. Research objectives and questions

The general objectives of this dissertation are to assess the effects of coffee sector reforms on household income and to guide government and developing agencies in their programs aimed at inducing poverty reduction among coffee growers in Rwanda.

The study has three specific objectives and associated research questions:

1. To identify variables driving poverty reduction in rural Rwanda. The associated research questions are:

   a. What are the determinants of household expenditures in Rwanda?

   b. Are the determinants of rural poverty the same among coffee growers and non-coffee growers?

2. To analyze the effects of coffee sector reforms in terms of the yearly household expenditures per adult equivalent, a proxy of income, on farmers

selling to two domestic channels: parchment coffee channel and coffee cherry channel. This part aims at answering the following questions:

    a. Have coffee farmers benefited from coffee reforms?

    b. Were the effects of coffee reforms the same across the two domestic markets?

3. To compare the impact of coffee supply chains (farmer cooperatives and private processors) on household income. Specific questions include:

    a. Does the type of coffee supply chain matter in poverty reduction?

    b. Which supply chain has benefited coffee growers the most?

1.3. Organization of the dissertation

This dissertation is organized in six chapters including this introduction. Chapter 2 provides a brief overview of the coffee sector in Rwanda and discusses some of the changes that followed the liberalization of coffee marketing in Rwanda. Chapter 3 identifies variables driving poverty reduction in Rwanda and elucidates any difference between farmers growing coffee and non-coffee growers. Chapter 4 analyzes how coffee reforms affected household income through the change over time in household expenditures of selected items with high budget shares. The same chapter examines whether the effects of coffee reforms were the same across the two domestic markets.

Chapter 5 examines whether the type of supply chain matters in poverty reduction. Finally, chapter 6 presents a summary of the results, discusses their implications for development policies, and associated recommendations for further research.

CHAPTER 2. OVERVIEW OF THE COFFEE INDUSTRY IN RWANDA

2.1. The coffee sector before coffee market reforms

Coffee was introduced by missionaries in the early years of the twentieth century. In 1930, Rwandan farmers were required by the colonial authorities to grow coffee on at least one fourth of their land (Boudreaux, 2007). The same authorities imposed taxes on coffee growers and export taxes on coffee sales. This situation went on until the Rwandan independence of 1962.

Between 1962 and 1994, the GOR used what Tardif-Douglin et al. (1996) called a carrot- and-stick approach. The carrot relates to the fact that the GOR provided high and stable prices to farmers, which protected them against price fluctuations of the world coffee market. The stick stood for the law that prohibited coffee farmers from uprooting coffee trees or intercrop coffee with other crops. The law also required farmers to implement coffee tree maintenance procedures.

Moreover, a state-run agency, known by its French acronym as OCIR (Office des Cultures Industrielles du Rwanda) was in charge of buying all coffee produced by farmers and exporting it. OCIR was created to control the production of coffee and tea. In 1964, OCIR was transformed in two main public agencies, one in charge of promoting the coffee industry and another in charge of tea production. These agencies were named respectively OCIR café and OCIR tea. In the same year, RWANDEX, another company partially owned by the GOR was created to be in charge of exporting coffee. These state agencies allowed the government to dictate price paid to producers, which was always below the free on board price (FOB). The differential between the two prices and imposed export taxes helped to generate Government revenues. In 1970, coffee exports generated between 60 and 80% of total official export revenues (Lode et al, 2004).

During the boom of the international coffee market, which took place in late 1980, the GOR dramatically increased the fixed price paid to farmers. Prices rose from 45 FRWA in 1974 to 120 FRWA in 1977[1] (Boudreaux, 2007). This increase in coffee prices gave incentives to farmers to increase production, but it also allowed the GOR to strengthen its control on the industry. It hired coffee extension agents for every commune to provide advice to coffee producers but also to monitor coffee production. For instance, if farmers failed to maintain good cultural practices of their coffee trees, they were punishable by law (Verwimp, 2003).

When the international coffee agreements terminated in the late 1990s, coffee quotas from coffee exporters were eliminated and it became difficult to continue implementing the previous price incentives. During this time and the years that followed, international coffee prices plummeted, and this was translated in low farm prices paid to farmers. The GOR continued, however, to subsidize coffee producers using the stabilization funds created during the international coffee market boom. In 1992, the GOR was, nevertheless, unable to continue supporting farmers as earnings from coffee export to finance the stabilization fund shrank. With low coffee prices, farmers wanted to stop producing coffee and shift into the production of more lucrative and staple crops such as banana and sweet potatoes, but the presence of local monitors made farmers worry about the consequences of ignoring the law that prohibiting the removal of coffee trees (Verwimp, 2003).

In brief, between the colonial period and mid 1990s, different GOR used coercive measures to ensure coffee production. They outlawed the destruction of coffee trees and

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[1] The inflation adjusted price was supposed to be 107 FRWA in 1977.

could punish farmers that do not maintain coffee trees very well. They also created a monopsony coffee buyer and a monopolistic exporter. Moreover, by imposing price caps for their product, farmers did not have incentive to work together to take advantage of scale economies or improve the quality of coffee because they were paid a fixed price regardless of the quality of their product. The following figure illustrates how the coffee sector operated before liberalization.

Figure 2.1. Administerd market (Colonial market -1995)

Farm gate price set
by OCIR-Cafe

F **F** **F**   **F** **F** **F**   **F** **F** **F**   Farmers

M   **M**   **M**   Middlemen:
parchment
purchasers

Factory gate price
set by RWANDEX

**RWANDEX:
only peeler/
polisher/miller/
exporter**

Price Unknown

**DRUCAFE:
importer
and broker**

38MT

**Commercial
Roaster and
Distributor** → ?

Price Unknown

54MT

**Commercial
Roaster and
Distributor** → ?

Source: DeLucco, 2006

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2.2. Coffee policy reforms

The coffee market has undergone various supply-control mechanisms aimed at stabilizing coffee prices. In the early 1960s, the majority of coffee producing countries, which account for 90% of global output and the major developed coffee–consuming countries created the ICO. The goal of this organization was to stabilize coffee prices through mandatory export quotas under the international coffee agreements. These agreements were indefinitely suspended in 1989 as they were not producing their intended outcomes (Baffes et al., 2005). The collapse of the ICO agreements led to changes in domestic coffee policies in many developing countries. The following section will briefly present some coffee reforms undertaken by the GOR after the collapse of the ICO agreements.

In 1990, with the support of the IMF and the WB, the GOR adopted a structural adjustment program. The goal of the program was to stabilize the economy and make it competitive, improve resource allocation and establish the basis for sustainable growth and poverty reduction (World Bank, 1997). The key components of the adjustment program included the following:

- Fiscal stabilization measures: reduction of government expenditures through strict controls on recruitment and salaries in the state sector and the elimination of price stabilization transfers to coffee producers as well as subsidies to state enterprises; and increased taxes on most goods;

- Monetary policy: increased interest rates and strict control on credit;

- Removal of price controls (except in the case of essential goods and services) and controls on profit margins (except in the case of some monopolies such as water and electricity);

- Full cost recovery for commercial and non-commercial services by introducing user fees for health, education and other state services;

- Abolition of import restrictions by converting them into taxes and introducing competitive tendering for import licenses;

- Restructuring and/or privatization of state companies;

- Promotion of private sector activities by adopting free market policies and increasing integration with the world economy through increased exports;

- Implementation of social 'safety net' measures to avoid the negative impact of the adjustment on the poorest.

By the end of 1992, all the previous reforms were implemented by the GOR except in the coffee and tea sectors. In the case of these two export crops, the setting of producer prices and export sales stayed entirely subject to the GOR monopoly and control. State controlled agencies facilitated the taxation of these sectors to provide revenue to the GOR budget.

The following reasons are given for the GOR to engage in heavy taxation of export crops: low price-elasticity of short-run supply leading to minimal impact of taxation on supply; less social and political resistance to taxation for cash crops than for food crops; simplicity of tax collection, which is facilitated by a unique marketing channel; and support for the GOR budget and balance of payments through foreign exchange earnings (Baffes et al., 2005).

The collapse of world bulk coffee prices in the late 1990s caused by the suspension of coffee quotas by the ICO resulted in a world glut, eroded incomes and threatened the long term viability of the industry (You et al., 2003). Since 1992, production and quality of coffee have been adversely affected as a result of war and the subsequent abandonment of Rwandan coffee areas (Walker, 2001). In 2002, approximately 20,000 tons were produced, down from 35,000 tons in 1992. Another explanation for poor performance of the coffee sector in Rwanda was the inability of the sector to keep pace with changes in the global high quality market (Loveridge et al., 2003).

Unlike in the pre-liberalization era, the GOR no longer obliges farmers to grow coffee. Farmers responded to low coffee prices by decreasing coffee production and a big number of farmers stopped growing coffee. Coffee census showed that the national share of farmers who were coffee growers went from 55% in 1991 to 30% in 2002 (Loveridge et al., 2003).

With the collapse of international coffee agreements, coffee prices are determined by market forces and are being influenced by large and low cost producing countries. Small countries like Rwanda cannot compete in the regular large volume and low quality market. In this market, small producers are price takers. Roasters are unwilling to buy coffee from countries that cannot guarantee a stable minimum amount of supply. For Arabica coffee, which is the main variety grown in Rwanda, the minimum supply is in the range of 60,000 tons, which is far above from what Rwanda has been producing. An alternative for countries like Rwanda is to build their competitive advantage in producing

for the high quality coffee market and capture market premiums offered by the emerging specialty coffee market.

In 1998, in response to diminishing returns resulting from the coffee global supply, the GOR understood that the viability of the coffee sector depended on producing high quality coffee, fully washed Arabica. Moreover, with the support of the international donor community and the involvement of coffee cooperatives and private sector entrepreneurs, the GOR liberalized the sale of coffee and embraced a policy of total quality management.

The first step the GOR took in liberalizing the coffee marketing was to redefine the role of the coffee marketing Board. Although the GOR liberalized the sale of coffee in 1998, OCIR café is still providing inputs (fertilizers and pesticides) and limited extension services to coffee growers. These services are mainly funded through a four percent export tax on coffee. Besides providing these services, OCIR-café plays a major role in formulating policies and strategies for the coffee sector and monitors their implementation. Moreover, the agency puts in place quality norms and classification systems. OCIR-café oversees quality control functions and provides certifications of origin. As a government agency, its role in assuring quality is put into question by some coffee stakeholders (Boudreaux, 2007).

The new market environment has allowed the emergence of the specialty coffee industry. Since the prices derived from this niche are higher than the prices of the regular commodity market, farmers have incentives to work together in cooperatives and pool their resources to meet the requirements of the specialty market. This helps them take advantage of scale economies and also improve the vertical coordination of the coffee

supply chain. In this liberalized environment, coffee cooperatives can freely contract with buyers to sell their product and avoid unnecessary costs of intermediaries who used to buy their coffee before the liberalization of coffee marketing.

2.3. The specialty coffee market

Specialty coffee is defined in many ways. The term covers all coffee that is not traditional industrial blends because of their high quality, their limited availability on the production side, or because of flavoring and packaging, or ambiance on the consumption side (Daviron, 2005). International coffee trade consists of "green" coffee, but coffee can also be sold in its soluble and roasted forms. Trade between producing and consuming countries consists mostly of green coffee and bulk instant coffee. The roasted coffee trade takes place mainly between consuming countries. In the case of Rwanda, coffee is mainly exported as green coffee.

Aspects of coffee quality content vary across coffee industry participants depending on what market segments and what country is analyzed. There are two main coffee markets: mainstream and specialty. In the mainstream market, roasters through their global brands manipulate quality attributes of coffee. Branding provides a guarantee of quality to consumers. In the specialty coffee market, quality is created in complex dynamics between small roasters and retailers, café chains and consumers. The distinction between the two types of coffee markets is, however, becoming difficult to identify as strong coffee players are pushing the specialty coffee industry towards representation of quality and coordination systems that are similar to the mainstream market. This is the case of the Starbucks Company, which is trying to couple its brand

name with coffee origins (Giovanucci et al., 2003). Rwandan coffee is mostly sold through the mainstream market.

Moreover, the development of new quality attributes and preoccupations with socio-economic and environmental conditions of production have led to the emergence of a sustainable coffee subsector of the specialty coffee industry. Mainstream coffee players are increasingly adopting some of the same sustainable practices of the specialty coffee market leading to the commoditization of sustainable coffee (Daviron, 2005). The main certification systems for sustainable coffee include organic, fair trade, shade-grown (bird-friendly coffee and rainforest alliance-certified coffee) and Utz Kapeh (now called Utz Certified) that certifies "socially and environmentally responsible" coffee, requiring adherence to their code and conduct.

The specialty coffee market is growing in the United States, Europe and Japan. The current demand is for quality and taste. These coffees are marketed not only as providing a unique and outstanding drinking experience but also as positively impacting the social and physical environment in the origin countries. They are typically grown on small, high altitude plantations. Specialty coffee types are Arabica varieties of the bourbon family. Care must be taken both on farm and during the coffee processing stage to produce the highest level of quality at the cup. Only a handful of countries have the environment necessary to produce these types of quality coffees. Rwanda is one of these fortunate countries and should take advantage of this recent trend in coffee consumption. Current market prices for gourmet types are from 3 to 15 times the price for commodity coffee (Olivieri, 2001), giving incentives to farmers to increase coffee production and reducing poverty.

Rwanda started producing specialty coffee in 2002 when the Partnership in Enhancement Agriculture in Rwanda through Linkages (PEARL) project supported a pilot coffee washing station owned by a cooperative of small growers of one of the poorest districts of the country. Since then there have been some successes from other cooperatives, which have used the PEARL model to sell to the high quality market segment. The high return from this market has also ignited some private investment in coffee processing and marketing. The volume of coffee sold through the specialty channel is still low, but high quality coffee from Rwanda is increasingly bought by many buyers including fair trade buyers and the Starbucks Company.

2.4. The coffee sector in Rwanda after market liberalization

Coffee remains one of Rwanda's most important official sources of foreign exchange and an important source of income among smallholder farmers (Schluter et al., 2001). In 2004, revenues from coffee exports topped other exports and generated $27.5 million compared to $25.6 million from tea exports, which came second (Economic Intelligence unit, 2007). Rwanda possesses ideal growing conditions for Arabica production. Coffee is produced along the entire shore of Lake Kivu in the western part of the country, as well as in the eastern, central and southern parts of the country. Rwanda's rich volcanic soils, rainfall distribution and mild yearlong temperatures favor the slow maturation of the coffee bean, which creates a distinctive taste in the cup. This constitutes a competitive advantage of coffee from Rwanda in the emerging and increasing high quality coffee market.

The supply response of coffee reforms has been notable. Coffee cooperatives and private investors have invested in coffee processing and marketing. They can now

purchase coffee cherries directly from growers and process them in their own factories

for the first time. This private investment has resulted in an increase of the production of

the high quality coffee as illustrated by Figure 2.2., and has made Rwanda a potential

producer for the specialty coffee market.

Figure 2.2. Improvements in the Quality of Rwandan Coffee

Growth of Quality

Legend: Fully Washed, Ordinary, Standard, Total

Source: www. Rwandacafe.com
Years 1997 and 1999 are not available in original source.
Years 2006, 2007 and 2008 are projected

Moreover, despite a 38 % drop of coffee production in 2005 compared to 2004,

2005 coffee revenues were higher than the year before due to an increase in coffee

quality as illustrated by Figure 2.3.

Figure 2.3. Rwandan Coffee Production (total production, fully washed, and export value): 2004 and 2005

Farmers selling coffee cherries through these new marketing channels (cooperative and private processors) receive a high share of the free on board prices and are paid promptly. They also save time as they no longer perform the first stages of coffee processing. Furthermore, a recent study showed that coffee producers who were before forced to grow coffee may have now shifted to more productive crops such as beans, therefore improving resource allocation (Donovan et al., 2002).

Coffee cooperatives with the help of NGOs and international donors started building washing stations, a necessary investment to produce specialty coffee and succeeded in entering in this new market. Their success in capturing high coffee premiums ignited private processors and other coffee cooperatives to start investing in primary coffee processing. Rwanda counted two state-run washing stations before 2000; it had more than 100 washing stations in 2007 (SPREAD, 2007).

Since Rwanda is new to the fully-washed premium market and largely unknown to specialty coffee industry participants, there was support by the GOR and its donors, particularly the USAID, to increase the value of exported coffee and establish market linkages with the rapidly expanding market for high quality and specialty coffees in developed countries (SCAA, 1999). The emergence of this high quality market raises the possibilities of increasing farm income and reducing poverty if a marketing channel can be established to ensure consistently high quality and consumers who value the product. The following section briefly discusses the contribution made by each one of the three USAID funded projects that allowed Rwandan coffee to be sold in the specialty coffee market.

2.5. Role of NGOs in the promotion of specialty coffee production in Rwanda

The liberalization of coffee marketing provided incentives to international donors to support NGOs and projects aimed at revitalizing the coffee industry. Various NGOs gave technical assistance to coffee cooperatives and entrepreneurs willing to invest in the production of specialty coffee. Three-coffee related projects: the PEARL project; the Agriculture Cooperative Development International/Volunteers Overseas Cooperative Assistance (ACDI-VOCA), and the Agribusiness Development Assistance project (ADAR) played a big role in supporting Rwandan coffee stakeholders who were attempting to capture opportunities offered by the new environment created by the liberalization of coffee trade in Rwanda.

2.5.1. PEARL

The PEARL project was a USAID-funded project led by Michigan State University and supported grower cooperatives in the production and marketing of specialty coffee, chili peppers and cassava products. The project also helped Rwandan agricultural institutions to rebuild their educational and research capacities. With respect to the coffee industry, the PEARL project started in 2001 by helping a coffee producers' cooperative build a pilot washing station. Washing stations are necessary to produce and market specialty coffee. The PEARL project also worked with other coffee growers' organizations to establish quality control systems. The farmer cooperatives had to implement quality controls to meet the requirements of the new industry.

In partnership with ACDI-VOCA, PEARL supported selected coffee cooperatives to develop business plans that were later submitted to local financial institutions. These cooperatives were able to access financial loans to build washing stations and receive necessary working capital to run the coffee factories. The project also trained the newly formed cooperatives in financial and organizational management (Goff, 2006).

The development of cooperatives was also facilitated by the GOR policy. In 2005, the GOR put in place a national policy to promote cooperatives. The policy stated that the GOR aims to use cooperatives as its main instrument for poverty reduction through rural economic transformation, human resource development and the promotion of the private sector (Bingen et al., 2002).

The PEARL project focused its attention on training coffee producers through their cooperatives on methods that improved coffee production and processing. The project supplemented the salary of public extension agents and these agents taught

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farmers good practices for mulching, tree pruning, applying appropriate fertilizers, lime and manure in their coffee fields. Coffee producers also learned the proper timing of harvesting cherries, the process of wet milling of cherries and coffee cupping. The ultimate goal of these efforts was to increase the quality of coffee and meet the demand of the specialty coffee market (Goff, 2006).

Besides teaching coffee cooperatives good practices to produce and process coffee, the PEARL project also helped coffee cooperatives market their coffee by establishing relationships with coffee buyers in the United States and Europe. Coffee companies that bought coffee from the new established coffee cooperatives supported by PEARL, included Community Coffee, Union Coffee Roasters, Intelligentsia Coffee, BD Importers, Thanksgiving Coffee, and the Green Mountain Coffee Roasters. In its efforts to organize coffee farmer organizations and help them sell their coffee to the specialty coffee market, the PEARL project outlined guiding principles that formed the model for successful agricultural outreach and technology transfer. These principles are: 1) work through farmer associations, cooperatives, and commodity groups as they form, 2) work through partnerships to strengthen farmer associations around key economic opportunities to add value and respond to market demand; 3) reduce risk through demand orientation, 4) focus on complete agricultural product supply chains from farm to table, 5) ensure local government buy-in and support, 6) place emphasis on local ownership and management, 7) build an integrated program of applied research that will address practical needs of the farmers and commodity associations, and 8) never overlook human resource training (PEARL website).

At the end of the PEARL project's term, a federation of twelve cooperatives that had been supported by the project was created. The federation was named the Rwandan Small Holder Specialty Coffee Association (RWASHOSCA). The aims of this local organization are to primarily market coffee from its cooperative members and pursue and strengthen the same partnerships PEARL has developed over the last years. This coffee company is expected to sustain the success of selling Rwandan coffee produced by its members to the specialty market.

2.5.2. ACDI-VOCA

This USAID-funded project started operations in Rwanda in 2002. The components of this project included natural resource management, agricultural productivity, agribusiness development, and the promotion of improved market access. Since ACDI-VOCA works with cooperatives, this project was a strong partner of the PEARL project. These two projects worked together to help cooperatives to develop business plans, obtain credit where needed, navigate the fair trade certification process and develop new and expanded market connections. As mentioned before, they also partnered in the construction of the first pilot washing station for the production of specialty coffee. The supported cooperative was the first in Rwanda to sell to the specialty coffee market in 2002. In that year, the cooperative sold 13 tons of green coffee to a London specialty roaster at $1.33/lb and 18 tons at $1.36/lb to a Baton-Rouge based coffee wholesaler. They also helped the same cooperative to be registered by the Fair-trade Labeling Organization (FLO).

In 2003, ACDI-VOCA supported another 2200-member cooperative of coffee producers (COOPAC: Cooperative pour la promotion des Activités-Café) to become fair-

trade certified and access the specialty coffee market (DeLucco, 2006). During that year, the cooperative was able to sell 20 tons at $1.26/lb to Lobodis, an FLO roaster in France and 18 tons via a Swiss broker named Schluter to Starbucks at $1.26/lb. Both cooperatives captured high prices by earning more than twice the prevailing New York price of $0.60/lb (CIF/NY). Moreover, they increased the efficiency of the coffee supply chain by shortening their marketing chains. Figure 2.4 shows the marketing channel of COOPAC, which represents the current marketing supply chain of a representative coffee cooperative or private processor that targets the specialty coffee market.

The only difference between a private and a cooperative washing station lies on the fact that owners of private washing stations buy raw coffee from independent or organized farmers who did not invest in the processing equipment. Private processors do not possess coffee fields and rely therefore on supply of coffee cherries from coffee growers for their processing needs.

When farmers sell coffee cherries, they receive the price mandated by the GOR. Since there are not well established quality standards for the coffee cherries, owners of coffee washing stations use subjective guidelines to select which raw coffee to buy or not. However, due to excess capacity of processing factories but also due to lack of understanding of specialty coffee requirements, many operators, particularly private processors, are more interested in buying high quantities of coffee cherries than focusing on quality of raw coffee to cover their operating costs (Bihogo, 2007).

Figure 2.3. A Representative Coffee Supply Chain that Targets the Specialty Coffee Market

Price Unknown

Starbucks

Schluter SA: Swiss broker

Transparent transactions: Price ($ 1.26/lb) represents fair trade floor price

LOBIDIS: Specialty FLO and relationship coffee roaster

38MT

54MT

COOPAC: the complete processing chain from wet mill to export

COOPAC returns to members:
• Initial 432 Rwanda francs/lb
• FLO Premium of $0.05/lb
• Revenues

F F F F F F F F F

Source: DeLucco, 2006

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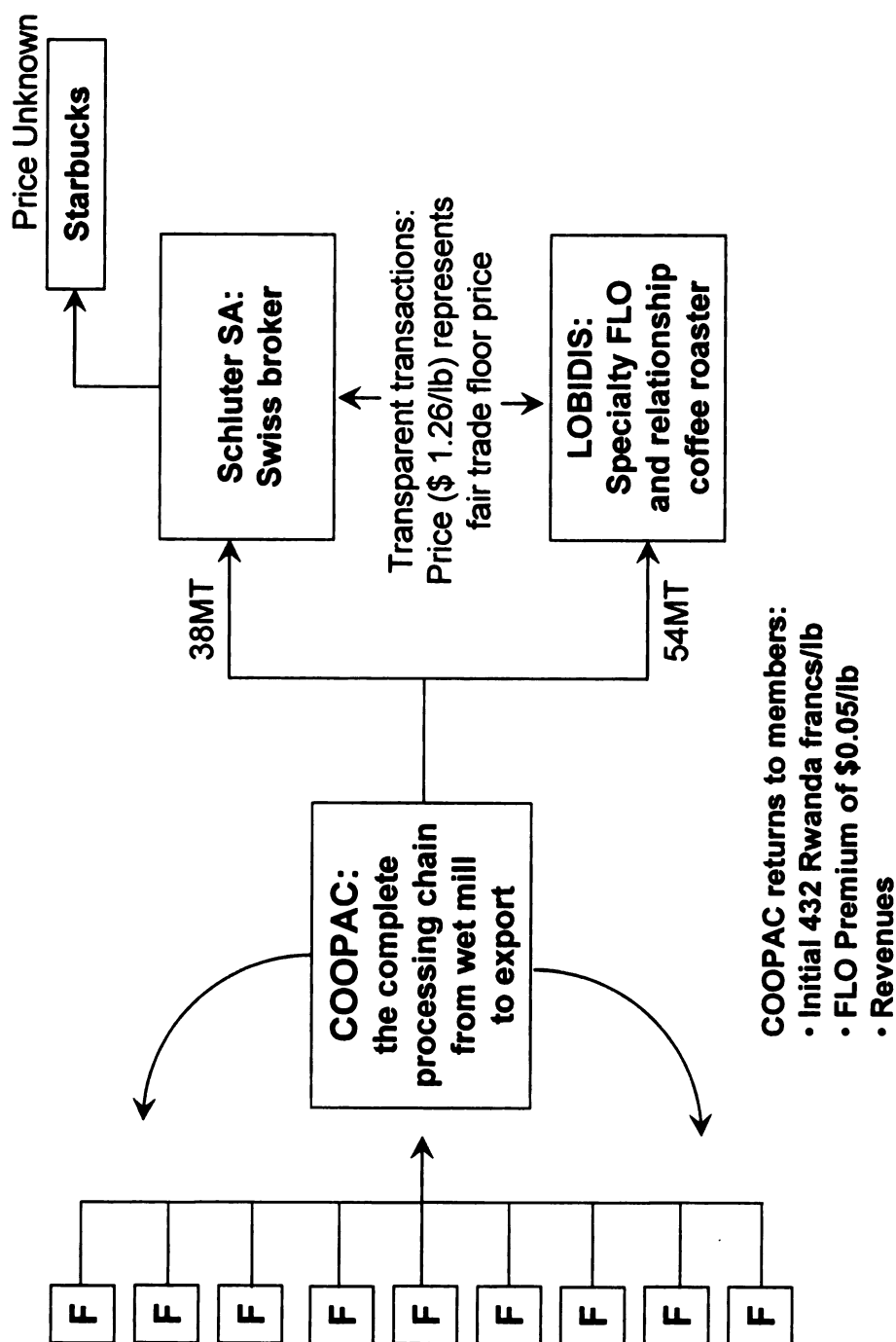
2.5.3. ADAR

Funded by USAID, this three year project was carried out by Chemonics International. ADAR's aim was to help Rwanda expand its production and marketing chain and increase the volume and value of agricultural products. While PEARL and ACDI-VOCA concentrated their efforts by working with cooperatives, ADAR worked with private entrepreneurs and created a private sector-led demand for coffee and other commodities. With regard to the coffee industry, the project supported private investors to carry out feasibility studies, write business plans and obtain loans necessary to build coffee washing stations. The project also trained private investors about the process of producing high quality coffee. Moreover, it provided technical assistance to farmers supplying coffee cherries to private washing stations. These farmers were taught how to better cultivate Arabica coffee and undertake other crop practices that lead to the production of high quality coffee cherries.
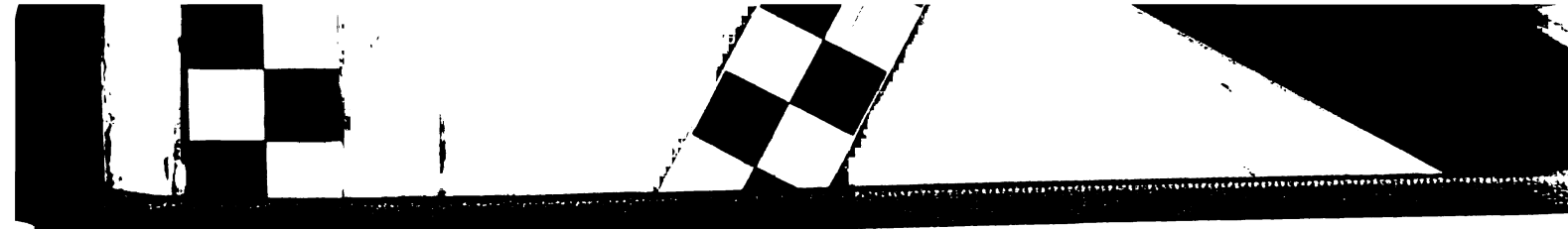
Markets reforms introduced in Rwanda in the mid-1990s in the coffee sector can be expected to have a fundamental impact in the institutional arrangements in which coffee growers undertake production and marketing decisions. The following section discusses market institution changes that emerged from coffee market reforms.

2.6. Market institutions in a reforming coffee industry

2.6.1. Provision of extension services and inputs

The GOR through OCIR-café is still providing the minimum level of inputs and extension services to farmers. These services are mainly funded through a 4 percent export tax on coffee. During the pre-liberalization period, farmers were receiving support in the form of inputs (pesticides, fertilizers) and stable coffee prices through the

stabilization fund. During the liberalization, this fund was exhausted and services to farmers are mostly provided by farmers' organizations and the private sector (Boudreaux, 2007). For instance, in the case of coffee operators selling to the specialty coffee industry, both access and quality of the extension services are currently provided by extension agents who are not paid by the GOR.
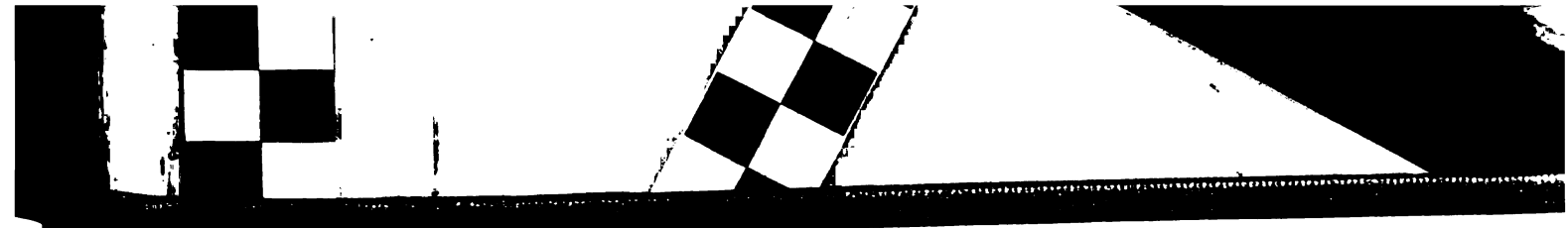
The degree of willingness in the provision of extension services is demand-driven, which is different from the way these services were given before the liberalization period. Private processors and coffee cooperatives provide these services to make sure that farmers will produce good quality coffee that will meet the quality attributes of coffee buyers. There is a market incentive of offering these services to keep and strengthen their relationships with coffee growers who are selling coffee cherries to them.

2.6.2. Agricultural research

Coffee research is undertaken by the coffee department of the Rwandan Agricultural Research Institute. The Institute is both government and donor funded. The focus of the Institute is the production of high yield, high quality and resistant varieties. A recent coffee study showed that coffee trees are old and this may explain their low productivity compared to neighboring countries' yields (Loveridge et al., 2003).

With the new emerging specialty coffee industry, some research is under way and sponsored by a new USAID project. The project is looking at processing techniques aimed at improving quality coffee and the possibility of Rwanda to produce shade-grown and organic coffee. Discussions have also started about how the private sector can fund these research initiatives.

2.6.3. Access to market information
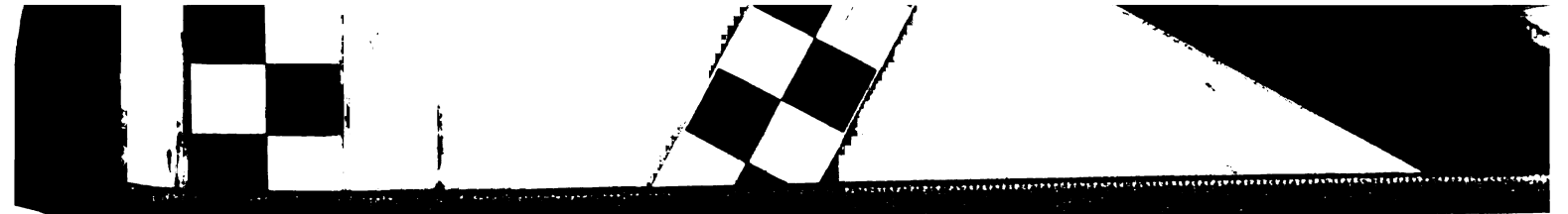
Market information is very important for an efficient marketing system as information facilitates rational decisions with respect to production, marketing and consumption. Since the introduction of coffee in Rwanda, the minimum coffee price has been determined by the GOR. With the need to sell to the specialty industry, the GOR is also fixing the minimum price of coffee cherries.

One of the advantages stated by farmers selling coffee cherries is that they no longer feel "cheated" by coffee traders, some of whom used to penalize them by unfairly lowering the assessed quality of parchment coffee. Traders used to provide asymmetrical information in their favor. For instance, some farmers reported that traders used to downgrade the quality of coffee to justify paying a price below the GOR mandated price.

Market forces of the traditional bulk commodity channel are different from the specialty coffee industry's forces, where there is high competition in the coffee cherry market. Coffee cooperatives and private processors pay to farmers at least the minimum price fixed by the GOR. Some coffee washing stations have put in place other incentive mechanisms to attract farmers and increase the throughput. This situation is caused by the fact that raw coffee supply does not meet the processing capacities of washing stations in almost every part of the country. Such competition is mostly prevalent in places where two or more competing washing stations exist.

2.6.4. Institutional changes in the coffee financial market

There are various institutions involved in the coffee financial market in Rwanda. The production of specialty coffee requires heavy investment in building coffee processing infrastructure capable of producing fully washed and high quality coffee.

Many financial institutions have given long-term loans to coffee cooperatives and private processors to build coffee washing stations. These formal financial institutions include commercial banks but also micro-credit institutions. The coffee sector lending was also facilitated by the GOR policy to encourage investment in coffee processing that adds value to the product. The GOR guarantees 40% of the total investment. Furthermore, to increase the availability of loans necessary to invest in coffee processing and marketing, the USAID has put in place a loan portfolio guarantee agreement with one of the leading commercial banks, the Kigali Bank (USAID, 2005).

CHAPTER 3. DISSERTATION ESSAY ONE
DETERMINANTS OF RURAL HOUSEHOLD EXPENDITURES AMONG COFFEE FARMERS AND NON-COFFEE FARMERS IN RWANDA

3.1. Overview of cropping patterns in Rwanda

The population of Rwanda has grown rapidly. It was 2 million in 1950, 4 million in 1964 and reached eight million in 1994. A 2002 census estimated Rwandan population at 8.2 million people, and the population was expected to reach 9.3 million by 2007 (Grosse, 1994; MINICOFIN, 2004). The majority of Rwandan population is rural and satisfies their basic needs through intensification of labor surplus on limited land resources. Rwanda is one of the smallest and most densely populated countries in Africa and its economy depends primarily on agriculture, which contributes about 45% of the gross domestic product (GDP) and more than 80% of total foreign exchange earnings (MINICOFIN, 2004).

Rwandan farmers responded to pressures created by socio-political, agro-climatic, land resource, population growth and economic circumstances by shifting their cropping behavior. The analysis of a household agricultural survey collected in 1990 showed that farmers responded to land scarcity by growing more bananas, beans and maize (Kangasniemi, 1988). The general trend of the agricultural system was a banana-based intensification and the main difference between farm size categories was that small farmers grow more sweet potatoes than large-scale farmers. In his 1998 PhD dissertation, Kangasniemi found that labor, coffee and banana were the three main sources of income of Rwandan rural households. In terms of revenue generation patterns, the 1990 survey found that beer and coffee dominated agricultural sales in all income quartiles. Moreover, between 1984 and 1990, banana areas had increased by 27% and sweet potatoes areas went up by 33%.
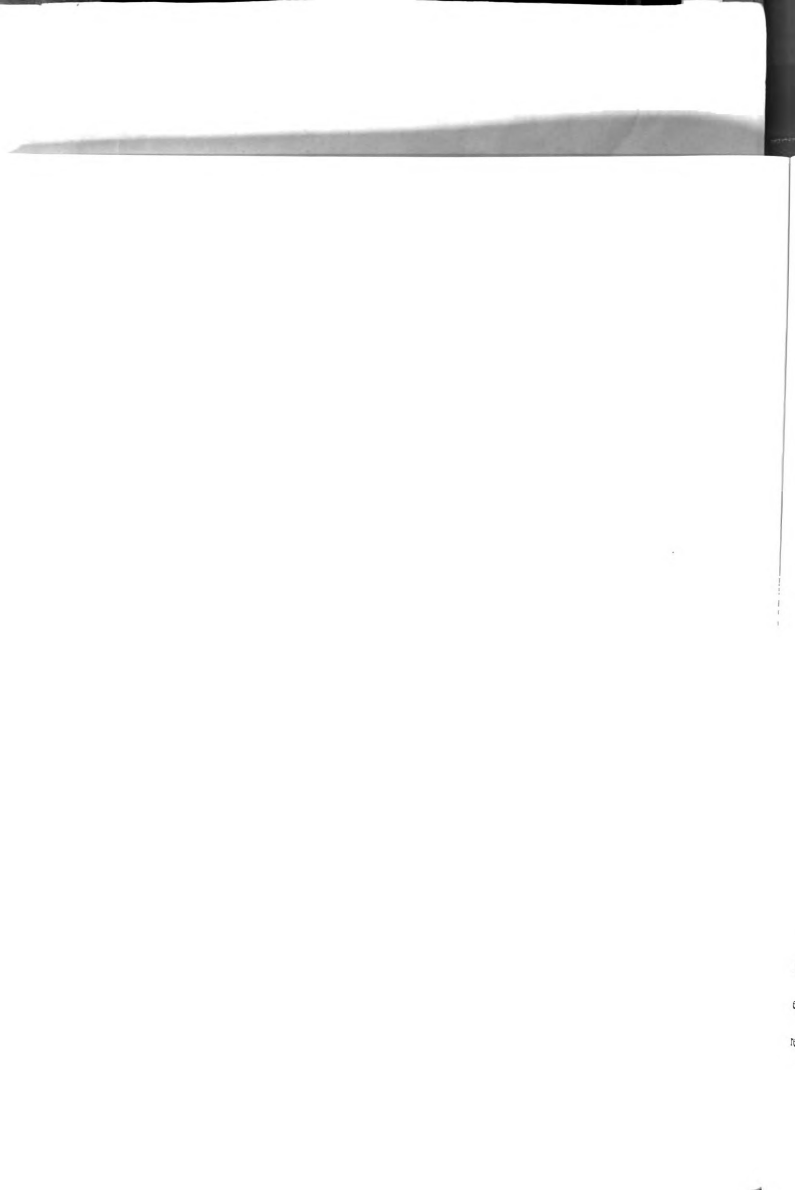
The analysis of agricultural household surveys collected between 1986 and 2001 has also shown a dramatic change in cropping patterns in Rwanda. For instance, in 1990, 42% of coffee growers harvested coffee compared to 18% in 2001. Furthermore, declines in aggregate output in coffee, banana and sweet potatoes crop production were also reported (Donovan et al., 2002). Another study looking at income and nutritional indicators found that the production of beans, cassava and Irish potatoes has increased while the production of cash crops such as coffee and banana has declined (McKay et al., 2005).

Although the changes in crop compositions can have some effect on household welfare, previous studies do not look at patterns in income strategies the change in cropping patterns can cause. The current strategy of the Ministry of Agriculture and livestock (MINAGRI), which is part of the National Agricultural Policy and the National Poverty Reduction Strategy, aimed among other goals, to diversify and intensify crop, animal and aquatic production. Within this framework, the GOR put emphasis on the promotion of the following commodities: rice in wetlands, maize, beans, wheat, Irish potatoes, oil crops such as soybeans, fruits and vegetables, tea and coffee (MINAGRI, 2004). Contrary to the findings of the agricultural household survey of 1990, which showed that banana was the main cash crop for rural Rwandans and was used to buy staple crops in the market, banana production is no longer promoted by current agricultural policies. Current government policies promote cereal production at the expense of roots, tuber crops and bananas. The design of appropriate intervention requires information on how farmers have responded to the current agricultural policy.

This chapter forms the first essay of this dissertation and paves the road to further analyses in chapters 4 and 5.The objectives of this chapter are to identify determinants of rural household income in Rwanda and elucidate any difference between farmers growing coffee and non-coffee growers.

3.2. Data and methods

3.2.1. Survey and community data

Chapter 3 uses the household expenditure survey conducted in 2001. Respondents from urban areas were excluded from the analysis because agriculture is not a major component of income of urban households. The data include 4461 non-coffee farmers and 498 coffee grower households.

Infrastructure variables (markets, roads, extension services, electricity) were collected through a community questionnaire. Responses to the questionnaire were given by key informants in rural areas. These data can be considered to be exogenous because they are not household specific but relate to all households that live in the same cluster.

3.2.2. Conceptual framework

There is a large body of literature on land use and income strategies of farm households. The current study does not attempt to provide a comprehensive overview of this literature but will instead briefly discuss some of the main factors relevant to the Rwandan agriculture sector. The discussion will be drawn from Figure 3.1.

Figure 3.1. Factors Affecting Income Strategies, Land Management, and Their Implications
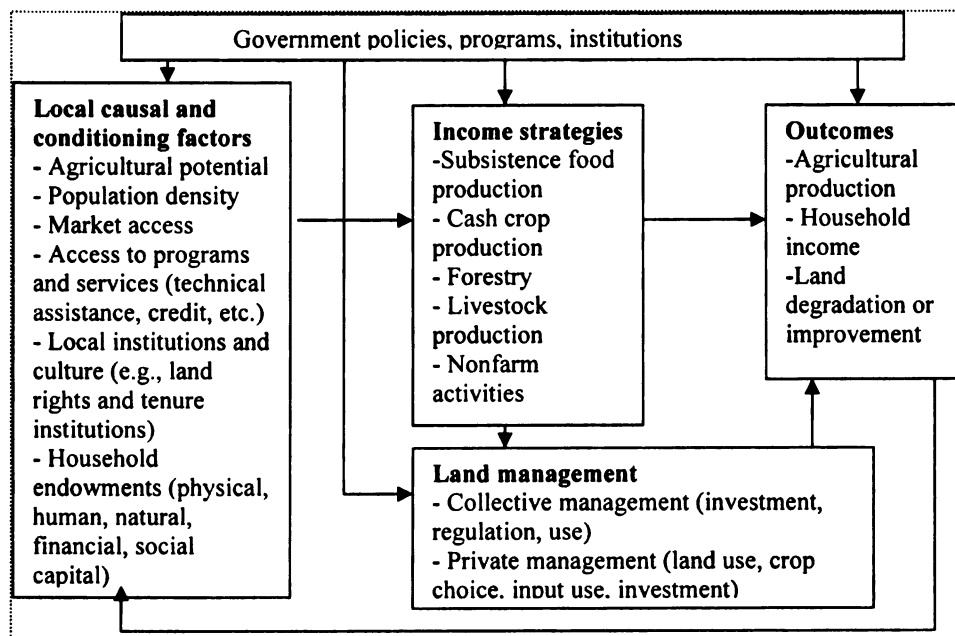
Source: Pender et al., 2006

Land use is determined by farm household decisions, farmers' groups and community decisions. Farmers choose whether to fallow, what crops to plant, what investment to make, and how to manage soil fertility on their land plots, etc. Moreover, farmers decide what to do on their farms by taking into consideration regulations on land use set by their governments or local authorities. Farmers' groups can also put in place regulations about managing communal lands and undertake collective investment.

Farmer households determine what they want to grow on their field and where to locate other inputs of production. These decisions have a direct impact on agricultural production, the level of farm income and household welfare. Agricultural policies and programs can have different impacts and can sometimes entail trade-offs among the objectives of farm households. For instance, policies that encourage farmers to reduce soil erosion by growing specific crops can result in less labor availability for other

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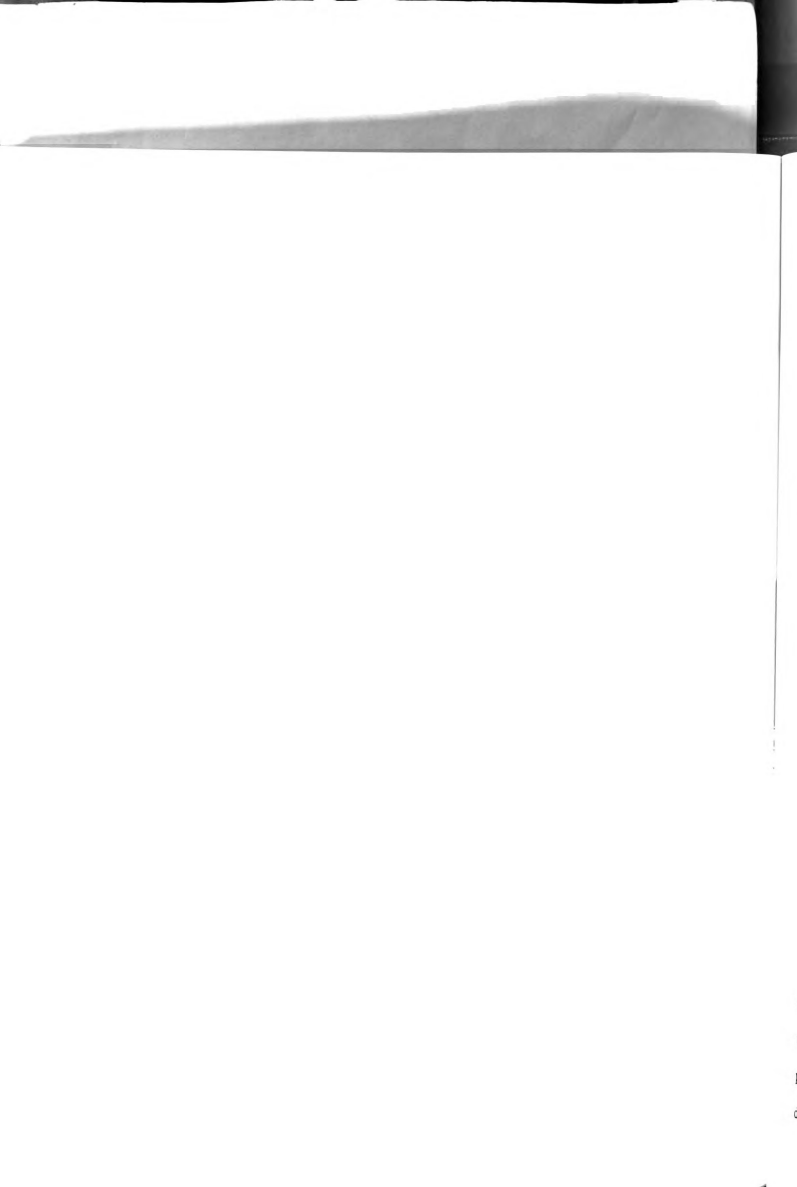
agricultural activities that can have significant implications for household food availability and household income. There are also win-win situations where agricultural production, income generation and improvement of resource conditions all increased (Nkonya et al., 2004).

Some factors influence land management either directly or indirectly. For instance, access to market can affect more the profitability of certain commodities than others. Moreover, population growth can increase the fragmentation of small-holder farms, which can reduce farmers' incentives to fallow, leading to low productivity of their farm holdings. Biophysical and socio-economic factors affect land management by determining income strategies of households. These are activities that farm households undertake to acquire income and goods (Nkonya et al., 2004). They include subsistence production of food crops, production of cash crops, livestock production, forestry and non-farm activities.

At the village level, factors such as agriculture potential, access to markets and population density influence income strategies of households. They determine the costs and risks of producing different commodities and define the comparative advantage of a location (Pender et al., 99, 2001). Rwanda is characterized by diverse agro-climatic zones implying a multiplicity of crops since some crops grow better in some agricultural zones than others. Moreover, farmers living close to urban centers have a comparative advantage to sell their products because they incur low transportation costs compared to remote areas. Access to markets can also influence which crops to grow because the relative high prices of some products can give incentives to growers to invest and produce them. Population density plays also a big role in income strategy. One way to deal with this pressure in a non-constrained environment is by land-based intensification,
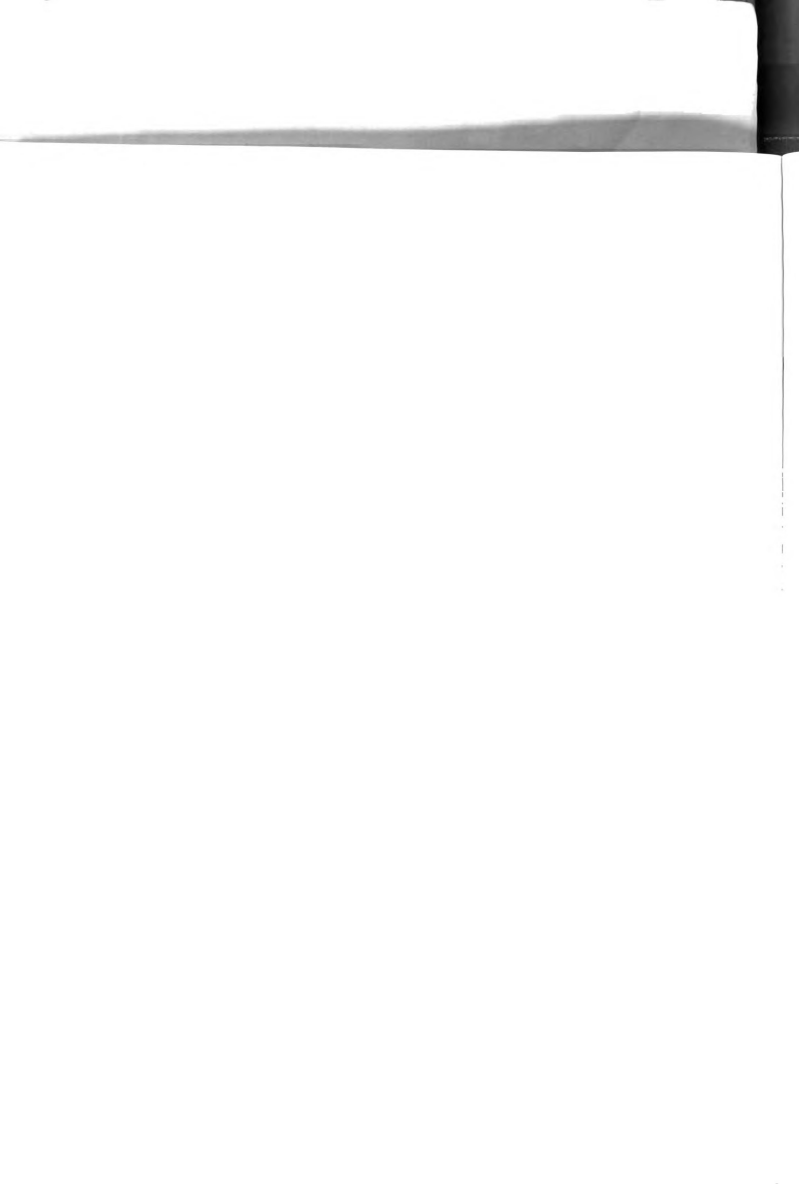
which is achieved by expanding crop fields. This is less likely to occur in Rwanda as the cultivable land area has already been occupied (MINAGRI, 1992).

At the household level, many factors determine income strategy and land management. These factors include: physical assets (livestock, equipment), human capital (education, experience, training), social capital (participation in organizations or networks), financial assets (credit and savings), and natural capital (quantity and quality of land, access to other resources).

Government policies and programs can also influence land management and income strategies in addition to their implications for production, resource conditions and household income. Using the Rwandan coffee sector as an example, coffee reforms introduced in the late 1990s combined with a glut in world coffee market led some farmers to stop growing coffee and investing in other income and food generating activities such as beans (Donovan et al., 2002).

Using the above conceptual framework, the next section aims to identify the determinants of rural household expenditures in Rwanda, a proxy of household income.

3.2.3. Empirical estimations

An econometric technique called quantile regressions was used to explore the role of agricultural and non-agricultural variables in poverty alleviation among coffee growers and non-coffee growers. While ordinary least-squared models (OLS) assume that the error term has the same distribution whatever values independent variables may take, quantile regression recognizes that covariates can play a significant role on the dispersion of the dependent variables as well as its location. Quantile regression methods complement ordinary least squared methods by providing a more flexible role for covariate effects and allow them to influence location, scale and shape of the distribution

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response (Koenker and Hallock, 2001). The flexibility of the effects of independent variables over the range of dependent variables in quantile regression is the main justification of using this method.

3.2.3.1. Independent variables

Table 3.1 shows the variables chosen as possible determinants of household income in Rwanda. These variables were selected due to economic theory that justifies their potential impact on poverty. The expected effects of these variables were explained in the discussion of the conceptual framework.

A brief explanation of the choice of some variables is given below.

Age of household head (AGE) was included because households at later stages in the household life cycle were less likely to be poor because they have the potential to earn income. Households with heads that are older and therefore unable to work are expected to be poorer than others. The quadratic variable AGE-squared was included to capture the slowly declining effect of age to household income.

Sex of household head (SEX) was included because households headed by women were expected to have less labor available for earning income and less access to higher paying employment. They are therefore expected to have less household income than households headed by men.

Table 3.1. Variables used in the determinants of household expenditure model

PEQA	Real household expenditure per adult equivalent
AGE	Age of household head (years)
AGESQ	Age of household head, squared (years)
SEX	Sex of household head (1=Male, 0 = Female)
HHSIZE	Number of household members
DRATIO	Ratio of those aged 12 and below, older children aged 13-18, and adults aged 60 and over, to adults aged 19-59 in the household
FSIZEPCAP	Land cultivated by household /household size (ha)
CRINT	Cropping intensity (area cultivated in seasons 1 and 2/ area available for cultivation (%)
STAPLE_SUM	Number of staple food crops grown in the previous two seasons
VSTAPLESPER	Value of staple food production to total value of crop production (%)
FOODSHARE	Share of land cultivated allocated to staple food crops (%)
TEADUMMY	Dummy variable for households growing tea (1=Yes, 0 otherwise)
COFFDUMMY	Dummy variable for households growing coffee (1=Yes, 0 otherwise)
VEGDUMMY	Dummy variable for households selling vegetables (1=Yes, 0 otherwise)
FRUITDUMMY	Dummy variable for households selling fruit (1=Yes, 0 otherwise)
VALSTOK	Current value of livestock assets/household size (000 Rfw)
SOLDMILK	Dummy variable for households selling milk (1=Yes, 0 otherwise)
SOLDEGGS	Dummy variable for households selling eggs (1=Yes, 0 otherwise)
AGWORKERS	Weighted number of agricultural workers per household
NONFARM1	Number of adults (19-59) with non-farm employment as primary occupation
FORMAL	Number of adults (19-59) with formal wage employment
AMNEVER	Number of adult males (25-59) who never attended school
AFNEVER	Number of adult females (25-59) who never attended school
AMPRIMARY	Number of male adults (25-59) who completed primary school
AFPRIMARY	Number of female adults (25-59) who completed primary school
HIGHEST	Highest education attained by any member of the household (years)
EXTENSION	Agricultural extension service available in community (Yes=1, 0 otherwise)
ELEC	Electricity available in the community (Yes=1, 0 otherwise)
MARKET	Daily/weekly market in community (Yes=1, 0 otherwise)
NORTH	Dummy variable for Northern Province (1=Yes, 0 otherwise)
SOUTH	Dummy variable for Southern Province (1=Yes, 0 otherwise)
WEST	Dummy variable for Western Province (1=Yes, 0 otherwise)
Coffdumm	Dummy variable for the coffee growers (1 = Coffee grower; 0= otherwise)
Coffefar	Coffee dummy interacted with land cultivated by household /household size (ha)
Coffeliv	Coffee dummy interacted with current value of livestock assets/household size (000 Rfw)
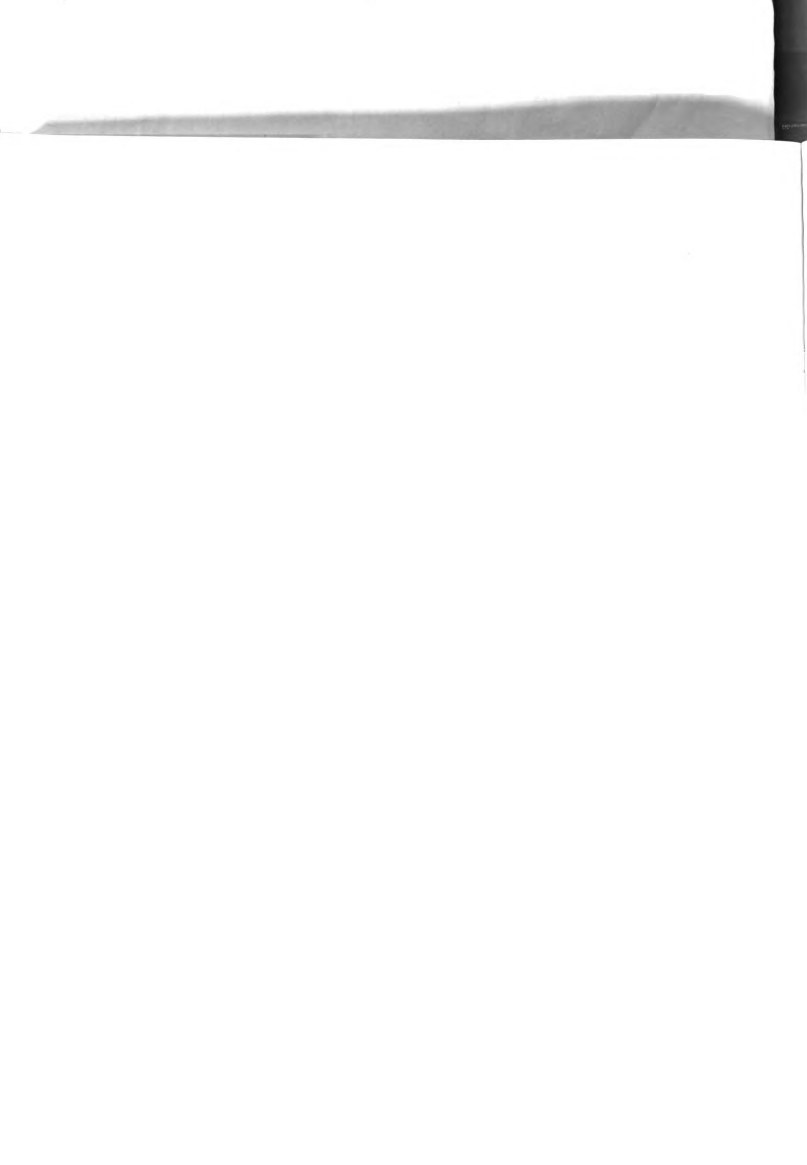
Table 3.1. continued

Coffeext	Coffee dummy interacted with agricultural extension service available in community
Coffefod	Coffee dummy interacted with share of land cultivated and allocated to staple food crops (%)
Coffesta	Coffee dummy interacted with number of staple food crops grown in previous two seasons
Coffeemp	Coffee dummy interacted with number of adults (19-59) with non-farm employment as primary occupation
Coffejob	Coffee dummy interacted with the number of adults (19-59) with formal wage employment
Coffelab	Coffee dummy interacted with the weighted number of agricultural workers
Coffemik	Coffee dummy interacted with a dummy variable for households selling milk (1=Yes, 0 otherwise)
Coffeegg	Coffee dummy interacted with a dummy variable for households selling eggs (1=Yes, 0 otherwise)

The number of household members (HSIZE) was included since larger households were expected to be poorer than others, as were households with a higher ratio of dependents (DRATIO), defined as the ratio of those aged 12 and below, older children aged 13-18, and adults aged 60 and over, to adults aged 19-59 in the household. These households require high income requirements for their survival and will have difficulty to meet them due to limited resources or opportunities to generate income.

Three variables are expected to capture the effect of "subsistence" agriculture on income. The number of staple food crops grown by the household (STAPLE_SUM) captures the degree of diversity in the crop mix, and lack of specialization in food crop production. The share of the cultivated area planted to food crops (FOODHSARE) and the relative value of staple food crops in total crop production (VSTAPLESPER) are also included to capture competition for land and resources between food and cash crops. The two variables are expected to be high for poor households. Five staple food crops (cassava, sweet potato, beans, maize, and sorghum) were used to compute the VSTAPLESPER variable.

To capture the effect of commercialization on household well-being, six dummies were included in the data set. These include the dummy variables TEADUMMY and COFFDUMMY for households that grew tea or coffee (traditional cash crops), the dummy variables FRUITDUMMY and VEGDUMMY for households that sold respectively fruit and vegetables, dummy variables for sales of milk (SOLDMILK) or eggs (SOLDEGGS). Households that grew these commercial crops and/or are involved in the sale of milk or eggs were expected to be associated with high expenditures.

Given the scarcity of farm land in Rwanda, area cultivated (FARMSIZE) was expected to be an important determinant of household income. Moreover, cropping intensity (CRINT), which measures area of land cultivated in both seasons as a percentage of the total area available for cultivation, is expected to be higher among poorer households with smaller farms for the same reasons mentioned in the case of FARMSIZE variable. If the land is cultivated in both seasons, the maximum value for CRINT is 200.

To identify the effect of different forms of employment on farmers' income, different employment variables were created. The number of workers in agriculture (AGWORKERS) is a measure of the household agricultural labor force, weighted according to age, whether employment was reported as primary or secondary and to the number of months they reported they were present in the household. The weights used were the following: adult males and adult females (19-59) with agriculture as their primary occupation, 1.0; adult males and females with agriculture as their secondary occupation, 0.5; older children (13-18) excluding students with agriculture as their primary occupation, 0.5; younger children (12 and below) with primary occupation in agriculture, 0. Moreover, a weight of one was given to people who were reported to
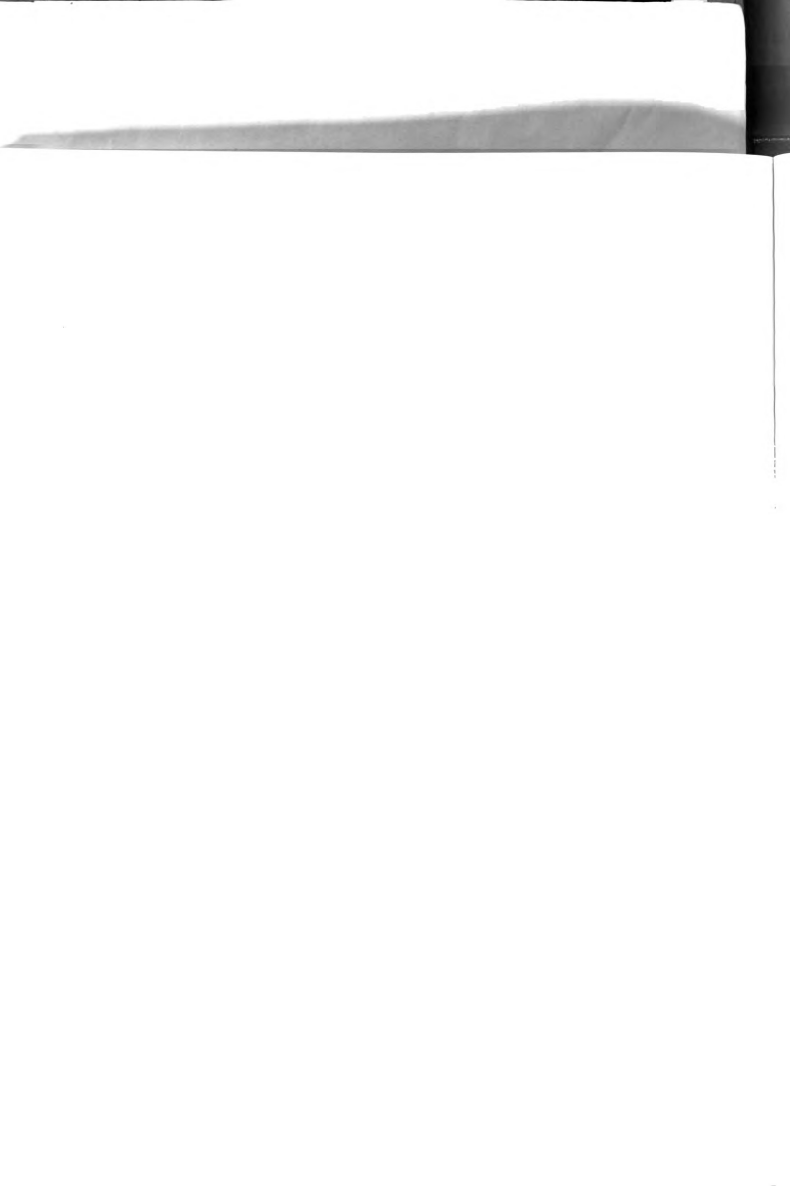
reside with the household for 12 months, with partial year residence weighted proportionally lower.

Other employment variables include the number of adults employed in non-agricultural jobs (NONFARM1) and the number of adults with wage or salary employment in the formal sector (FORMAL). The two variables are associated with higher income.

Educational attainment variables were used to capture the role of education on income. These variables include the number of adult males and females who had never been to school (AMNEVER, AFNEVER); the number of adult males and females who had completed primary education (AMPRIMARY, AFPRIMARY) and the highest educational attainment by any member of the household (HIGHEST). Adults are defined as people between age 25 and 59.

The regression analysis also used infrastructure variables that are expected to have a positive impact on household income. These include the existence of a market (MARKET), access to electricity (ELEC), and the existence of agricultural extension services (EXTENSION).

Finally, to capture regional differences between provinces, dummy variables were used for NORTH, WEST, and SOUTH provinces of Rwanda. The Eastern province was used as the base. The inclusion of a regional dummy in the model specification addresses the omission bias problem because agricultural potential varies across regions. The provincial dummies also capture unobservable effects that can explain poverty differences across the different provinces of Rwanda.

To test the importance of some factors for the coffee growers relative to the non-coffee growers, interaction terms between the variables of interest and the dummy

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variable for the coffee growers were created. Interaction terms include the following variables: coffefar = coffee dummy interacted with land cultivated by household /household size (ha); coffeliv = coffee dummy interacted with current value of livestock assets/household size (000 Rfw); coffeext = coffee dummy interacted with agricultural extension service available in community (Yes=1, 0 otherwise); coffefod = coffee dummy interacted with share of land cultivated and allocated to staple food crops (%); coffesta = coffee dummy interacted with the number of staple food crops grown in the previous two seasons; coffeemp = coffee dummy interacted with the number of adults (19-59) with non-farm employment as primary occupation; coffejob = coffee dummy interacted with the number of adults (19-59) with formal wage employment; coffelab = coffee dummy interacted with the weighted number of agricultural workers; coffemik = coffee dummy interacted with a dummy variable for households selling milk (1=Yes, 0 otherwise); and coffeegg = coffee dummy interacted with a dummy variable for households selling eggs (1=Yes, 0 otherwise).

3.2.3.2. Dependent variables

The outcome variable of interest is the yearly adult equivalent expenditures (PEQA), a proxy of income. The use of the adult equivalent expenditure variable normalizes household expenditures by taking into account age and gender differences within the household. However, these differences may not have a big influence on household expenditures for non-food goods.

To take into account possible discontinuities or sign–changing relationships, the yearly adult equivalent expenditures has been divided into four expenditure categories or quartiles. High expenditure quartiles stand for being rich whereas lower quartiles stand for being poor. Regression results indicate which variables are correlated to the yearly
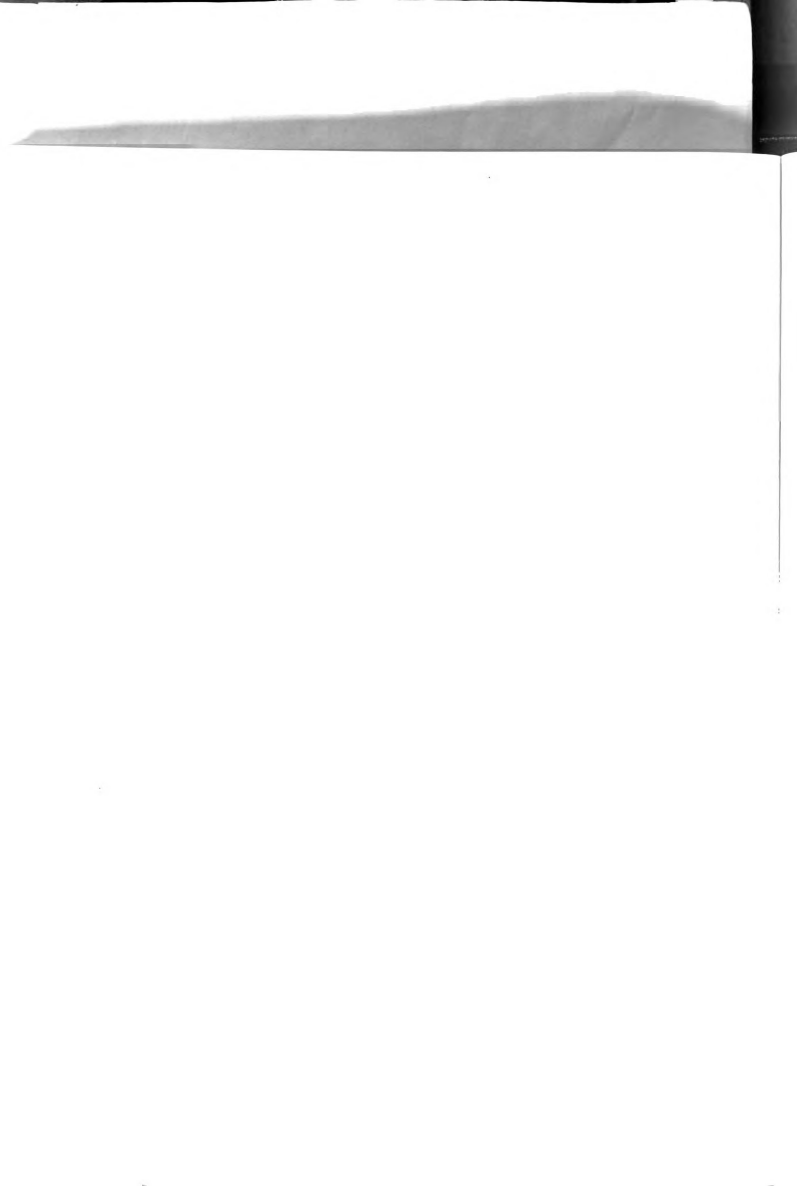
adult equivalent expenditure. Table 3.2 gives the descriptive statistics of selected variables and results of a test for significant differences across coffee growing and non-coffee growing households.
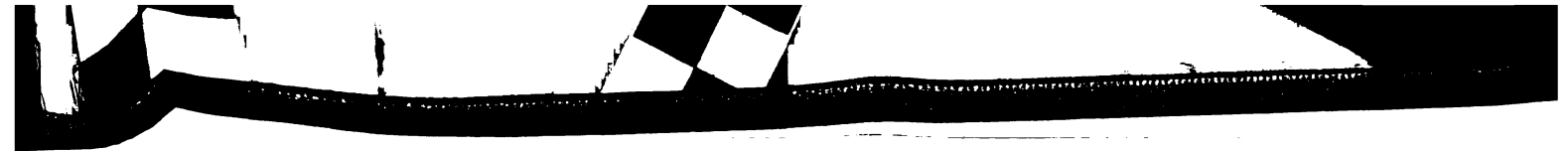
3.2.3.3. Limitations of the econometric analysis

The quantile analysis may be subject to omitted variables bias, where other potential determinants of rural household income in Rwanda were not included. The regression analysis has included many variables that are relevant to the Rwandan economy. The analysis has also taken into consideration the diversity of agricultural potential or income opportunities across Rwanda by including regional and socio-characteristics dummy variables, minimizing therefore the omitted bias problem.

3.3. Regression results

For all quartiles, the Pseudo R-squared are 0.18 and this indicates that the independent variables explain about one fifth of the variability in the outcome variable, the yearly adult equivalent expenditures. Table 3.3 provides the coefficients and standard errors of the variables used in the regression model of the determinants of rural household income in Rwanda. Variables significant at 5% or better are in bold font. Results indicate which variables are associated to the annual household expenditure per adult equivalent across the four different quartiles.

Non-agricultural variables that have a strong impact on household expenditures include education variables, non-farm and formal employment variables. The level of education of farmers appears to be a determinant factor of household income and presents the same effects across the different quartiles. More adult males and females with no education are negatively associated with household expenditures. On the other hand, households with more females who attended primary school are positively associated
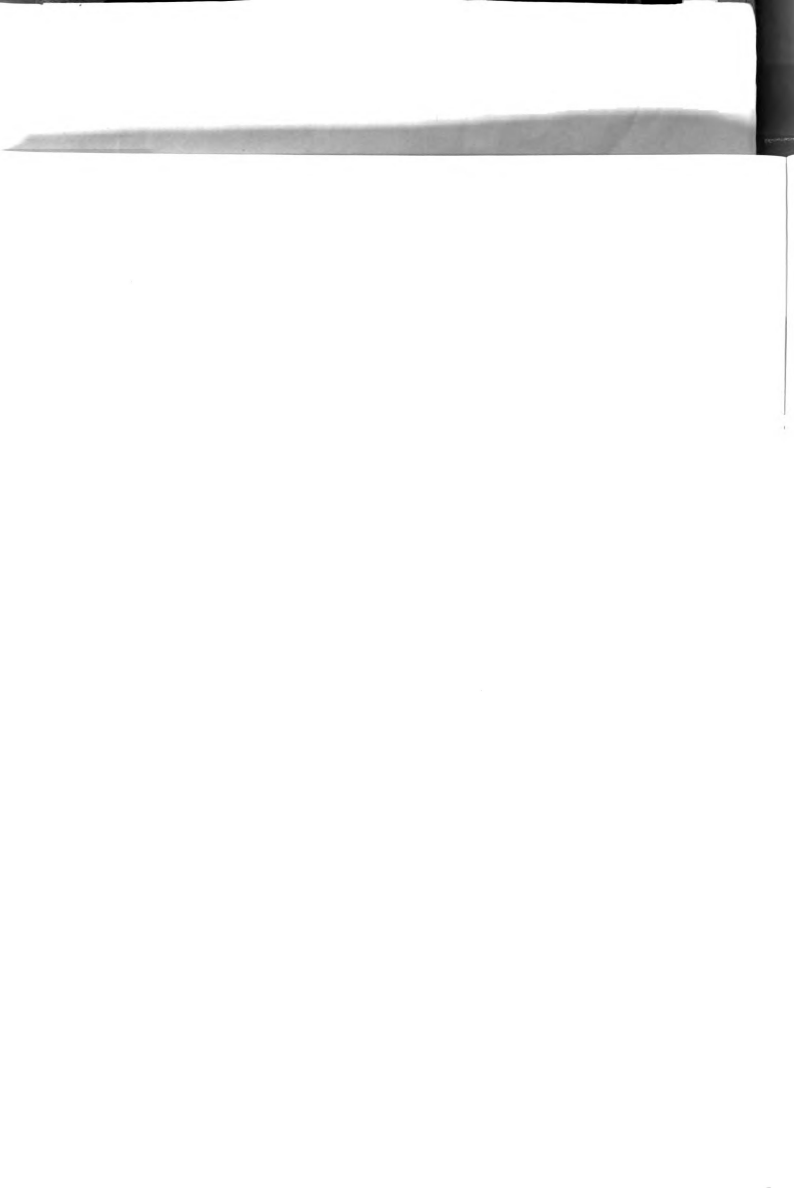
with household expenditures. This is also true for households with many males who attended primary school.

Non-farm employment and participation in the formal wage market were significant across quartiles with the expected pattern. More employment in non-farm activities and the formal wage was positively associated with household expenditures. A World Bank study that investigated the probability of not being poor using the same data set through a probit regression confirmed the role of education and non-farm opportunities in escaping from poverty (Diop et al., 2005).

Agricultural variables, which were significant across all expenditure quartiles, include the farm size per capita, the number of agricultural workers/household, the number of staple crops grown, and whether the household is selling fruit, milk or eggs. Increasing farm size per capita contributed significantly to increasing household income and therefore reducing poverty. The results also showed that more agricultural workers per household are negatively associated with household expenditures. This is a sign of the decreasing return to labor in the land-constrained environment of Rwanda.

Furthermore, the number of staple crops grown is a significant determinant factor of rural household income, although their role is not the same across the different quartiles. The number of staple food crops grown in the previous two seasons has a somewhat more positive effect of household expenditures in the lower tail of the dependent variable distribution than in the upper tail, varying from 2% in the lower tail to 1% in the upper tail.

Table 3.2. Descriptive statistics of selected variables

	Survey	N	Mean	t-value	Sig. (2-tailed)
Household size	Coffee Growers	498	5.37		
	Non-Coffee Growers	4461	4.91	4.187	.000
Staple_S	Coffee Growers	498	9.58		
	Non-Coffee Growers	4395	8.10	8.144	.000
nonfarm1	Coffee Growers	498	.8483		
	Non-Coffee Growers	4461	.7596	2.5335	0.0116
peqa	Coffee Growers	498	66268.65		
	Non-Coffee Growers	4461	65734.07	0.2413	0.8094
agworker	Coffee Growers	498	2.09		
	Non-Coffee Growers	4461	1.94	2.6898	0.0074
Formal	Coffee Growers	498	.050		
	Non-Coffee Growers	4461	.052	-0.1399	0.8888
fsizecap	Coffee Growers	498	.18		
	Non-Coffee Growers	4461	.16	2.0288	0.0429
highest	Coffee Growers	498	5.62		
	Non-Coffee Growers	4461	4.44	3.3411	0.0009

Moreover, the results showed poverty differences across regions. Living in the southern province of Rwanda is significantly and negatively associated with household

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expenditures. The southern province variable exerts a quite uniform and negative effect over the range of the distribution of about 6%. Over the last six years, the PEARL project has been helping coffee growers, particularly in the southern province, to export to high quality markets. Further analysis using recent household expenditure surveys can explore if the project has helped in reducing poverty in that province.

Table 3.3. Sign and significance of determinants of household expenditure model

| | Quantile regression estimates for different quartiles | | | | | | | |
| | 20th | | 40th | | 60th | | 80th | |
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Intercept	4.5401	0.0524	4.6884	0.0438	4.8101	0.0425	4.9861	0.0631
SEX	-.0628	0.0150	-0.0277	0.0114	-0.0177	0.0121	-0.0146	0.0153
AGE	-.0036	0.0020	-0.0030	0.0019	-0.0034	0.0019	-0.0025	0.0023
Agesq	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HHSIZE	-0.0348	0.0047	-0.0302	0.0032	0.0268	0.0031	-0.0239	0.0034
agworkers	-0.0349	0.0108	-0.0371	0.0069	-0.0464	.0070	-0.0628	0.0094
nonfarm1	0.0625	0.0167	0.0548	0.0116	0.0726	.0109	0.0714	0.0148
formal	0.1660	0.0259	0.1535	0.0203	0.1400	0.0227	0.1271	0.0274
amnever	-0.0464	0.0144	-0.0454	0.0127	-0.0404	.0122	-0.0330	0.0129
Afnever	-0.0091	0.0138	-0.0288	0.0101	-0.0276	.0102	-0.0245	0.0129
Amprimary	0.0319	0.0201	0.0400	0.0157	0.0449	.0168	0.0565	0.0182
Afprimary	0.0684	0.0164	0.0516	0.0121	0.0535	.0149	0.0427	0.0172
highest	0.0012	0.0009	0.0020	0.0008	0.0021	.0006	0.0017	0.0008
dratio	0.0002	0.0001	0.0003	0.0001	0.0002	.0000	0.0003	0.0001
fsizecap	0.1883	0.0587	0.2052	0.0413	0.2497	.0320	0.2473	0.0362
crint	0.0001	0.0001	0.0002	0.0001	0.0000	0.0001	0.0001	.0001
staple_sum	0.0246	0.0021	0.0192	0.0015	0.0162	.0016	0.0129	0.0018
vstaplesper	0.0003	0.0002	0.0000	0.0001	0.0000	.0002	0.0000	0.0002
foodshare	-0.0004	0.0002	-0.0003	0.0002	-0.0003	.0002	-0.0003	0.0002
teadummy	0.0636	0.0455	0.0344	0.0392	0.0262	.0426	0.0315	0.0479
vegdummy	-0.0005	0.0115	-0.0120	0.0109	-0.0075	.0104	-0.0204	0.0129
fruitdumm	0.0249	0.0137	0.0302	0.0119	0.0215	.0103	0.0310	0.0125
soldmilk	0.1368	0.0400	0.1294	0.0335	0.1005	.0372	0.0955	0.0430

Table 3.3. continued.

Quantile regression estimates for different quantiles

Variable	20th Coef.	20th Std. Err.	40th Coef.	40th Std. Err.	60th Coef.	60th Std. Err.	80th Coef.	80th Std. Err.
soldeggs	**0.0490**	0.0207	**0.0528**	0.0149	**0.0582**	.0190	**0.0673**	0.0261
valstoK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
extension	-0.0119	0.0116	-0.0248	0.0098	-0.0156	.0102	-0.0131	0.0115
elec	0.0078	0.0219	.0180	0.0178	0.0331	0.0141	0.0184	0.0223
market	-0.0053	0.0129	-0.0062	0.0143	0.0069	0.0122	0.0158	0.0141
north	0.0046	0.0203	0.0030	0.0140	-0.0157	0.0140	-0.0024	0.0172
south	-0.0644	0.0172	-0.0635	0.0136	-0.0622	0.0145	-0.0636	0.0129
west	.05636	0.0170	0.0416	0.0129	0.0276	0.0158	0.0252	0.0157
coffdumm	-0.0870	0.0747	-0.0933	0.0671	-0.1108	0.0635	-0.1259	0.0758
coffeliv	0.0008	0.0012	0.0013	0.0014	0.0012	0.0013	0.0002	0.0011
coffefar	-0.0882	0.0764	-0.0321	0.0824	-0.1137	0.0868	-0.0197	0.0876
coffeext	0.0038	0.0323	0.0379	0.0300	0.0445	0.0316	0.0225	0.0317
coffefod	0.0014	0.0006	0.0004	0.0006	0.0001	0.0006	0.0005	0.0006
coffesta	-0.0063	0.0042	-0.0010	0.0041	0.0069	0.0037	0.0028	0.0038
coffeemp	-0.0712	0.0301	-0.0040	0.0276	-0.0394	0.0328	-0.0350	0.0312
coffejob	-0.0768	0.0775	-0.0755	0.0902	-0.0191	0.1042	-0.0146	0.0916
coffelab	**0.0519**	0.0183	**0.0288**	0.0122	**0.0318**	0.0144	**0.0412**	0.0193
coffemik	-0.0942	0.0922	-0.2127	0.1090	-0.1481	0.1199	-0.0525	0.1013
coffeegg	0.0299	0.0481	0.0074	0.0512	0.0401	0.0509	0.0131	0.0537
cofvstap	0.0003	0.0006	-0.0002	0.0005	-0.0003	0.0005	-0.0001	0.0007

The study investigated if determinants of household expenditures differed between coffee growers and non-coffee growers. Data for coffee growers and non-coffee growers were pooled together to test the importance of some key determinants for the coffee growers relative to the non-coffee growers. The pooled regression analysis includes a dummy for the coffee growers and interaction terms between the variables of interest and the dummy variable for the coffee growers. Similar factors that were found to be associated to household income for both categories of farmers include the following: the sum of staple crops grown, education, the farm size per capita, and the dummy
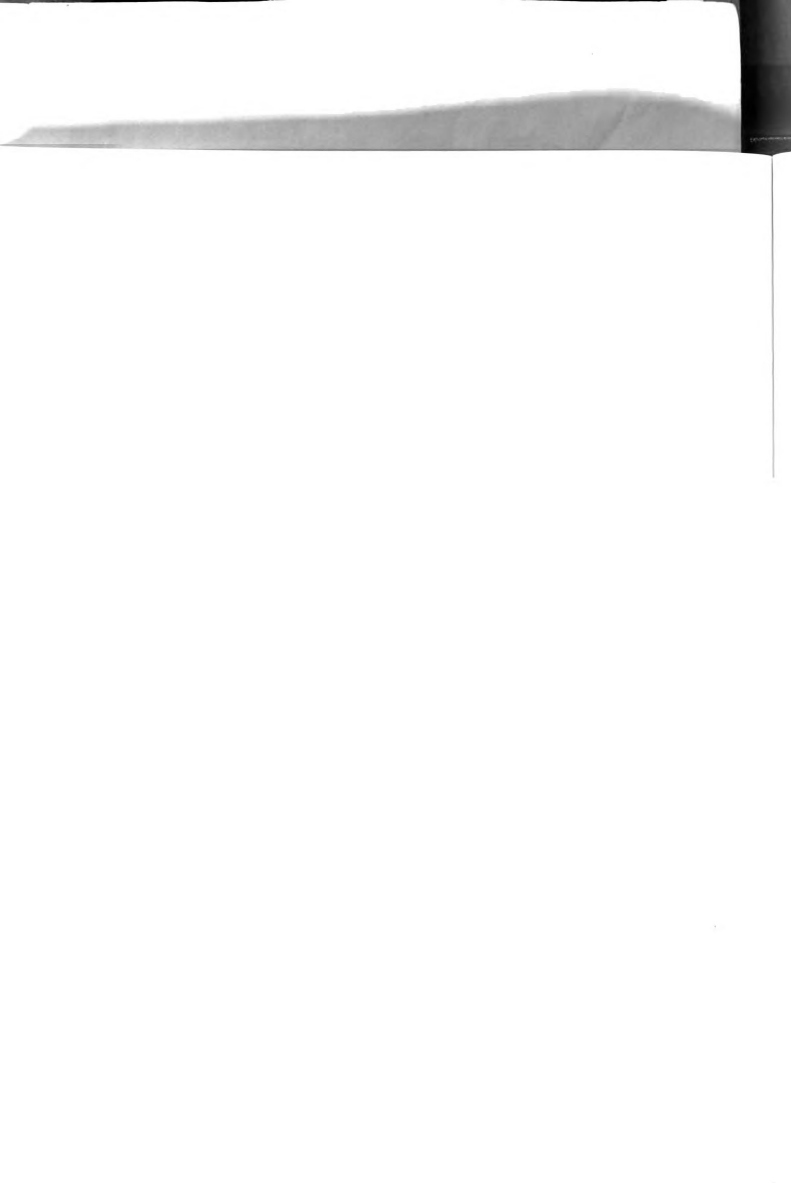
variables of whether or not a grower is selling eggs or milk, and the southern province dummy variable.

One key determinant of household income that seems to affect differently the two categories of farmers is the weighted number of agricultural workers per household. While more agricultural workers were negatively correlated to household expenditures across different quartiles for non-coffee growers, this was not the case for coffee growers. The positive effect of labor availability on household expenditures among coffee growers reflects the fact that coffee production is a labor-intensive enterprise. More labor available to the household will tend to be fully utilized among coffee growers than among non-coffee growers.

3.4. Conclusions and policy implications

This study gives an empirical contribution of the role of agricultural and non-agricultural variables on rural household income in Rwanda. Rwandan current Economic Development and Poverty Reduction Strategy stipulates that to eliminate poverty, Rwandans should replace subsistence agriculture with commercial agriculture. Findings of this study showed, however, that growing a large number of staple crops was positively associated to household expenditures for both coffee growers and non-coffee farmers. These findings confirm the documented complementarities between cash crops and food crops in raising household income (Zesch, 1987). These results call for policies that support research and dissemination of technologies that increase the yield of staple crops and economic return of the land-constrained capital.

Similarly, the farm size per capita, which was a very significant determinant of household income, can be addressed using the same strategy of improving land
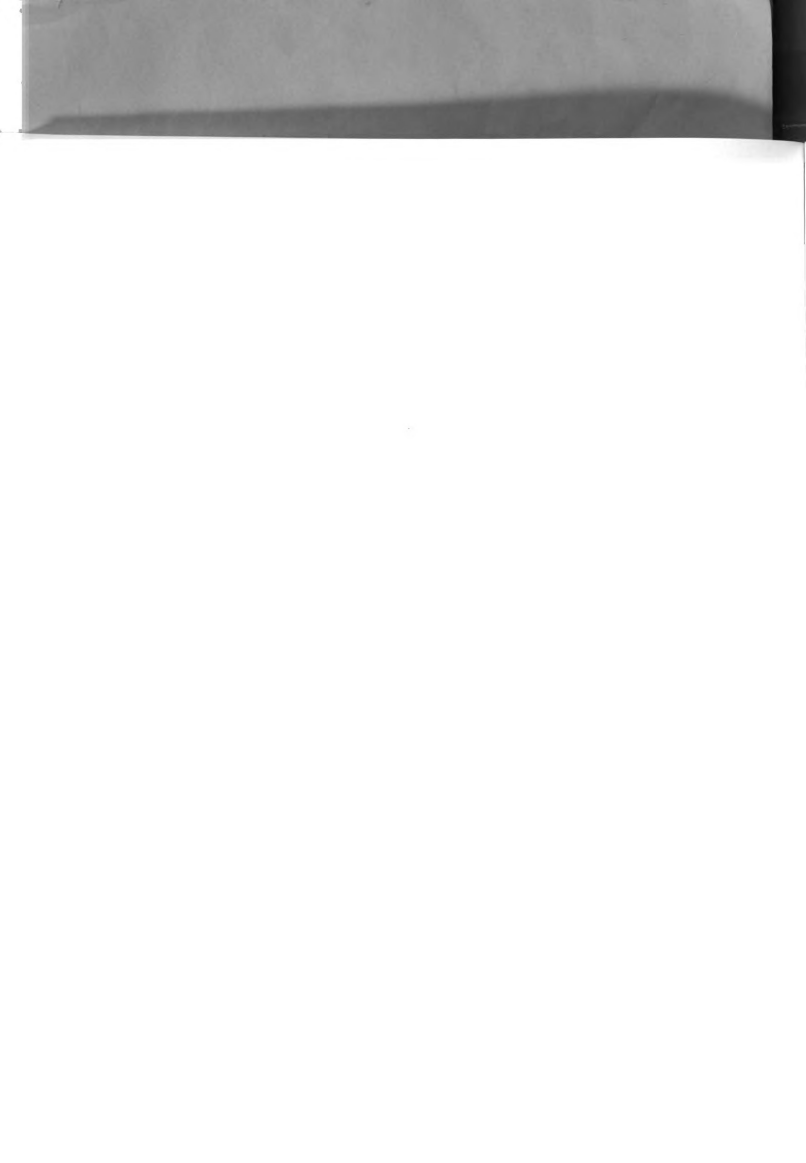
productivity. The productivity increase of staple crops will also allow other sectors of the Rwandan economy, such as animal and cash crop production to contribute positively to economic growth and poverty reduction.

The results found that off-farm income opportunities and formal wage were associated with increasing household income. Moreover, sales of livestock products, such as milk or eggs, as well as the production and sale of fruit contribute significantly to improving household income. Policies to increase the proportion of farmers engaged in off-farm activities, animal and fruit production will therefore be important in improving the well-being of farmers.

The results also highlight the high return of education for both coffee and non-coffee growers. This was consistent with the 1990 data analysis that showed that the availability of skilled labor is still a big constraint of the Rwandan economy (Kangasniemi, 1988). The findings of this study also highlight regional differences in terms of poverty, which shows that the southern province seemed to be behind others in terms of poverty level. Policy makers should take into consideration this fact and put in place programs that address these inequality differences across provinces.

The Rwandan coffee industry has experienced many changes particularly after the liberalization of coffee marketing. Coffee reforms coupled with the emergence of specialty coffee have provided incentives to invest in coffee quality improvement, which allowed farmers to earn higher prices and other benefits as spillover effects of the reforms. The next chapter of this dissertation analyzes the effects of coffee sector reforms in increasing household income in Rwanda.

CHAPTER 4. DISSERTATION ESSAY TWO
HAVE COFFEE GROWERS BENEFITED FROM COFFEE REFORMS IN RWANDA?

4.1. Introduction

Studies of the impact of market reforms on smallholder farmers show that households, as producers and consumers, respond by taking advantage of opportunities created by them. They also react to reforms by protecting themselves from their adverse effects. Winters et al. (2004) noted, however, that while market reforms can facilitate poverty reduction, their findings were not conclusive regarding the exact direction of the impact of the reforms either in theory or empirically. The inability to generalize the direction of the impact of market reforms on farmers has been explained by the fact that outcomes depend on circumstances that underline the economic conditions of the targeted population and measures taken to implement the reforms.

In Rwanda, the coffee sector has gone through domestic deregulation since the mid 1990s. The liberalization of coffee policies allowed for instance farmers to choose to grow coffee or not. One specific feature of the Rwandan coffee industry relies on the fact that coffee marketing is not fully liberalized. The GOR has been setting minimum prices at the beginning of the coffee season (Boudreaux, 2007). During discussions via focus groups, many coffee farmers stated that the minimum prices do not reflect the production costs of coffee farming.

Previous studies (e.g. Bussolo et al., 2007, Deininger et al., 2003) have extensively focused on the supply response caused by high prices as a consequence of market liberalization. These studies documented the positive response that followed an increase in output prices as a result of market reforms. Although the contextual environment of setting prices does not provide the right signal for a positive supply

response, the reforms have contributed to farmers' decisions to allocate the already scarce resources in different ways than they were before the reform.

Furthermore, the coffee reforms in Rwanda were implemented during a period of international coffee surplus, which resulted in low prices offered to farmers. A coffee survey conducted in 2002 showed a drop in number of farmers growing coffee. Fifty percent of rural farmers in Rwanda were coffee growers in 1991, compared to 30% in 2002 (Loveridge et al., 2003). The same study found that many farmers were interested in intercropping coffee. The effects of these changes have not yet been assessed. This study aims to fill this empirical gap by analyzing how coffee policy reforms have affected smallholder income through the change over time in household expenditures of selected items with high budget shares. This chapter forms the second essay of the dissertation and assesses whether coffee households have benefited from these reforms.

The domestic coffee market in Rwanda is segmented into parchment coffee destined for the bulk market and cherries that may be used for higher grade coffees. Prices of parchment coffee from the conventional market are not always lower than prices offered by the new coffee cherry market. In a survey conducted as part of this study, farmers were asked whether coffee cherry prices were fair with respect to the counterfactual prices from the parchment coffee market. Many farmers said they were not satisfied with current coffee cherry prices, particularly during the 2007 coffee season when parchment coffee prices were relatively high compared to the years before. One question for research is whether the effects of coffee reforms on farmers were the same across the two domestic markets. This chapter also responds to this empirical question.

The Rwandan coffee industry has gone through many transformations. Farmers used to process their coffee and dry it before selling it to traders on a spot market. Many farmers currently have an alternative coffee market where farmers sell coffee cherries to processing plants owned by coffee cooperatives or private investors.

As farmers sell coffee through the two different channels, the analysis of the effects of coffee sector reforms in terms of household expenditures, a proxy of income, will shed some light about how the reforms affected the economic conditions of coffee farmers. This is particularly important as the current coffee debate concentrates on the emergence of Rwandan specialty coffee and pays less attention to the large population of producers who still sell to the commodity market.

This essay forms a new empirical contribution of the analysis of market reforms. The specific features of the Rwandan coffee sector will broaden the existing knowledge of how coffee sector reforms affected farmers. The anticipated results of the study are also important to agricultural policy in other export crop countries. In Rwanda, results may assist the GOR in the liberalization of other export crops such as tea. Tea production is the second largest value agricultural commodity of the Rwandan economy.

The outline of this chapter is structured as follows. The second section gives the overview of domestic coffee markets in Rwanda. The third section presents the conceptual framework of the study. The fourth section contains the survey design, the description of data and estimation methods. The fifth section discusses the results of the study. Finally, the sixth part presents the main conclusions of this dissertation essay and policy recommendations.

4.2. Overview of domestic coffee markets

Government policies in the coffee industry have aimed to transform the sector in a way that targets the high quality market and moves away from the bulk coffee market. Rwanda is a small coffee producer. The small scale of coffee production combined with the fact that Rwanda is a land-locked country does not give it a competitive advantage in the international commodity market. The high quality market, especially the specialty market, is a growing industry and offers high prices to coffee producers. The quality coffee market is, however, thin and all coffee produced in Rwanda is not sold via this channel.

Reforms in coffee marketing and coffee quality improvement have allowed private investors and coffee cooperatives to invest in quality enhancing practices such as building processing factories, also known as coffee *washing stations (CWS)*, to target the growing specialty market. The investment in these facilities has not yet, however, covered the whole country. A large percentage of growers still process coffee using the pre-reform techniques and sell it to the regular commodity market. The coffee sold in this market is called *parchment coffee*. Parchment coffee is the coffee that has gone through preliminary processing stages. In general, farmers selling parchment coffee are located in places where some conditions for building processing plants, such as enough water to process coffee do not exist. Moreover, they may also be located in non-coffee intensive zones where investment in coffee processing is not profitable.

Owners of processing facilities buy raw coffee, which is called *coffee cherries*. Farmers who sell to the coffee cherry market face a different market structure from farmers who sell to the parchment market. After the liberalization of coffee purchasing, buyers of coffee cherries (coffee cooperatives and private entrepreneurs) have emerged,

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leading to a high competition in the raw coffee market in many parts of the country. Besides a relatively high price compared to the parchment coffee price, coffee cooperatives and private investors offer extension services and sometimes credit to coffee farmers. Farmers who sell parchment coffee do not receive these benefits. These benefits are predicted to have a strong effect in consumption smoothing and reducing poverty (Badiane et al., 1999).

OCIR café regulates coffee quality standards and marketing. At the beginning of the coffee season, the GOR in consultation with OCIR café fixes the minimum price for both coffee cherries and parchment coffee that will be paid to farmers. These prices are expressed in Rwandese francs per kilogram (FRWA/Kg). One kilogram of parchment coffee is obtained from approximately five kilograms of coffee cherries. Farmers who are not selling parchment coffee deliver coffee cherries to a coffee washing station or to a coffee collection center owned by a private processor or a coffee cooperative.

On delivery, farmers get paid immediately or can wait until they have sold enough cherries. Some farmers prefer not to be paid right away for fear that they will not spend the money properly or sometimes for fear that the money will get stolen as there are no rural financial institutions where they can deposit coffee earnings. Processors also deduct outstanding loans the farmers owe them. At the end of coffee season, profitable coffee cooperatives pay back dividends to members if the cooperative has made profits. Many coffee cooperatives are still paying loans received to build the processing factories and are not able to pay dividends to their members. With respect to owners of private processing facilities, some give bonuses to farmers who supply large quantities of coffee cherries during the coffee harvesting season.

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Coffee production has been low over the last decade as a result of low coffee prices received by farmers. Growers did not have economic incentives to maintain coffee trees and increase production. Owners of coffee processing factories are therefore struggling to get enough raw coffee to meet their processing needs, resulting in high competition in the coffee cherry market and high operating costs due to excess capacity.

To acquire more cherries, buyers have adopted incentive mechanisms to attract suppliers. Before and during the harvest season, cooperatives and private processors offer market incentives to their members and farmers who are supplying or are expected to sell coffee cherries to their processing factories. These incentives include consumption credits in cash or in kind, school loans, extension services, or input loans such as fertilizers, etc. Moreover, coffee cooperatives use an open membership policy that accepts new membership applications, and farmers can still sell coffee cherries through the cooperative without being a member. These incentives contribute to improving coffee production and respond to the cash constraints of farmers. The high competition of coffee cherries in some areas has also resulted in high prices offered to farmers. These prices are sometimes higher than the minimum GOR mandated prices, representing extra profit to farmers as they do not have to pre-process the cherries.

4.3. Conceptual framework

This study examines the effects of coffee policy changes on farmers selling coffee to two domestic markets: the coffee cherry market and the parchment coffee market. The outcome variables of interest are adjusted total annual expenditures per adult equivalent and annual food expenditures per adult equivalent, during the 2001 and 2007 coffee seasons.

This chapter makes use of a general program evaluation model (Ravallion, 2005).

Let Y_c represent the per adult equivalent of annual household expenditures of a farmer

selling coffee cherries to a cooperative or a private entrepreneur that processes coffee

through the washing station. Y_p represents per adult equivalent of annual household

expenditures of a farmer who processes coffee himself and sells parchment coffee. The

outcome variable of farmers selling coffee cherries can be specified as:

$Y_{ci} = X_i \beta_c + \xi_i$ (1) where X_i is a vector of variables associated with household

expenditures. These are observable characteristics affecting the outcome variables, the

subscript i denotes the farmer in question, β is a vector of parameters, ξ_i is the error

term.

Similarly, the outcome variable of a farmer who sells parchment coffee can be specified

as:

$Y_{pi} = X_i \beta_p + \xi_{pi}$ (2)

The expected gain from selling coffee cherries instead of parchment coffee is denoted by

$E(\Delta) = E(Y_{ci} - Y_{pi})$ (3).

Farmers are expecting to sell coffee cherries instead of parchment coffee if the

expected gain from selling the raw coffee, net of costs of dealing with the coffee cherry

market, exceeds zero. The net gain, except coffee production cost, can be defined as

$I_i = (E(\Delta) -$ cost of selling to coffee processors).

$= Z_i \alpha + \xi_i$ (4) where Z_i is a vector representing factors of selling to the coffee cherry market, α is a vector of parameters, ξ is the error term. I_i is unobserved and it is assumed that farmers will sell to the coffee cherry market if $I_i > 0$. What we observe is whether a grower has sold coffee cherries, denoted in this framework as ($T_i = 1$) or has sold parchment coffee, denoted here as ($T_i = 0$).

Assuming coffee reforms have affected household expenditures through equations (1) and (2), the model of effects of coffee reforms can be rewritten as:

$Y_i = X_i \ \beta + \gamma \ T_i + \varepsilon_i$ (5).

The effect of the type of the coffee market on the dependent variable is measured through γ. The dummy variable of the choice of the domestic market is treated as exogenous as the decision to sell either coffee cherries or parchment coffee is not based on individual selection (equation (4)). There has been a vigorous information campaign to encourage farmers to sell coffee cherries unless there is no processing facility nearby. The number of farmers who are not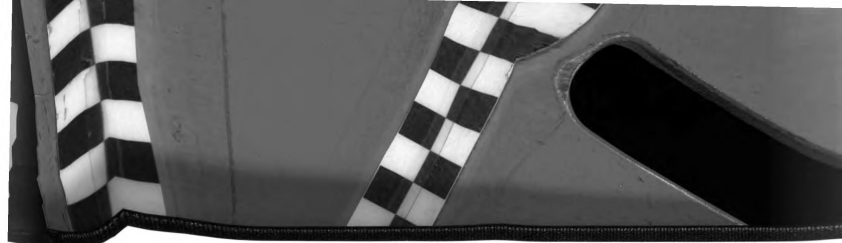 responding to this call is very minimal. Farmers who sell coffee cherries usually receive cash right away, and do not have to process their cherries into parchment coffee. These conditions attract farmers to the coffee cherry market. The proximity of the farmer to a processing facility is typically the sole determinant in the farmer's choice of where to sell his/her coffee. Using the conceptual

framework, the exogeneity assumption of the market choice variable means that Cov (ε_i,

ξ_i) = 0.

However, the placement of coffee processing plants is not randomly assigned. Investors build these plants based on other factors that are not captured in this framework. The non-randomness of the placement of coffee washing stations will be dealt with through an instrumental variable method, which will be explained in the next section.

4.4. Data and estimation methods

4.4.1. Survey design

A coffee household survey was conducted via a panel data set of 264 coffee growing households. Coffee growers were identified from the Livelihood Conditions Survey conducted by the Ministry of Finance and Economic Planning (MINECOFIN) in 2001. From the 2001 random sample, farmers who grew coffee at that time were selected. The study did not revisit all coffee growers that were respondents in the 2001 survey due to limited financial resources. Only clusters with more than 3 coffee growers were identified and included in the 2007 coffee survey.

In 2001, farmers were visited eight times during a period of 16 days whereas in 2007, the same households were visited five times during a period of 10 days but adjustments were made consistently while constructing variables for use during data analysis. The 2001 random sample forms the baseline sample and characterizes the conditions that prevailed before the major coffee reforms because in 2001, farmers were
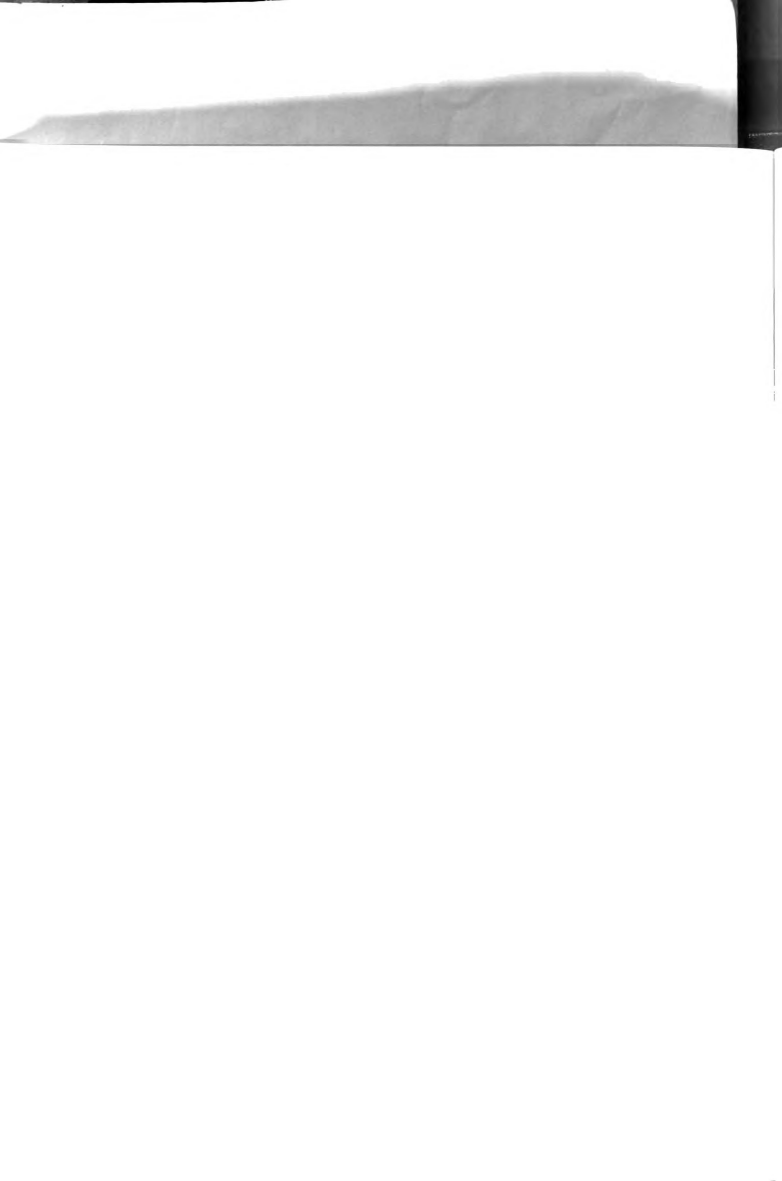
mostly selling parchment coffee. Farmers started selling coffee cherries in 2002 when investment in coffee processing facilities started as a response to coffee policy changes.

One of the weaknesses of this sample is its size. The desire to evaluate the effects of coffee reforms between 2001, the ex-ante policy period, and 2007, the ex-post policy period, combined with limited resources to revisit all coffee growers sampled in the 2001 survey explain the current sample size. Another weakness is sampling bias associated with the normal processes of aging, dissolution, and formation of households. The sample likely under-represents younger households, but the bias is likely minimal as Rwandan farm households are not very mobile, and the time interval is modest. The sample may under-estimate effects if non-grower households were incentivized to grow coffee by the reforms and improvements in market outlets. Again, the effects should be minimal due to the time lag associated with coffee tree maturation.

The coffee survey included three categories of growers: those belonging to coffee cooperatives and whose coffee cherries are supplied to the cooperative washing stations for processing and marketing; those who sell their coffee cherries to a private processor that owns and operates a coffee processing plant; and producers who sell parchment coffee to the traditional market. The first two groups are considered treatment groups. This last category is used as a control group.

After cleaning the data set, a final sample of 252 households was obtained for further analysis. Table 4.1 gives the distribution of coffee respondents by province and domestic coffee channels. The table shows that coffee is mainly produced in the Southern and Western provinces. The same table also implies that coffee processing facilities are
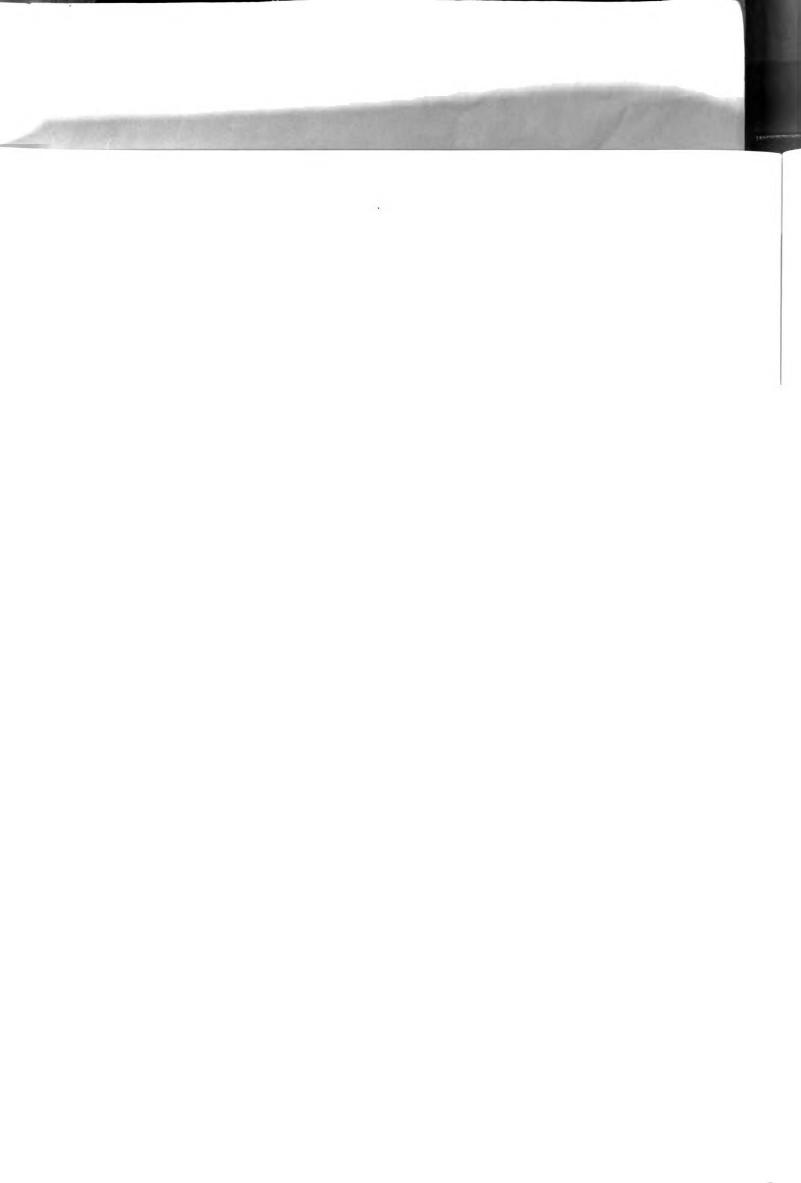
not easily accessible in all parts of the country given the large number of farmers who sell parchment coffee.

4.4.2. Description of data

The data include outcome variables of interest, which are the adjusted annual food and total household expenditures per adult equivalent, and some explanatory variables, which are determinants of household expenditures of coffee farmers.

4.4.2.1. Dependent variables

The dependent variables of the analysis are the yearly adult equivalent of food and total household expenditures of survey respondents in 2001 and 2007. The dependent variables are expressed in constant prices. The adult equivalent expenditure is preferred as a proxy of income because it helps to correct for the age and gender distribution within the household. To be consistent with previous poverty analysis in Rwanda and to accommodate potential discontinuities or sign changing relationships, another candidate of the dependent variable can be constructed by dividing the yearly adult equivalent of expenditures into consumption quintiles. However, due to limitations associated with the sample size, data analysis did not make use of consumption quintiles. The following section discusses how the dependent variable was constructed.

Table 4.1. Distribution of coffee respondents across coffee channels and provinces, 2007 survey

	Province				Total
	East	North	South	West	
Number of respondents selling parchment coffee per province	2	8	51	43	104
Number of respondents selling coffee cherries per province	24	17	36	71	148
Total number of respondents by province	26	25	87	114	252

Source: Author's calculations

The annual food and total household expenditure per adult equivalent were constructed based on household consumption data. The consumption data of the coffee survey is the short version of the 2001 survey. The financial limitations precluded the use of the long questionnaire of the 2001 household living standards survey. To reduce the survey length, the 2007 coffee expenditure questionnaire was reduced by making use of data from the 2001 survey to select food and non-food items that have the highest budget shares. Twenty food items and ten non-food items that represent more than 80% of total household expenditures were selected. The food items include the main products purchased, home grown and auto-consumed commodities. Appendices 4.1 and 4.2 give the types of items and their respective budget shares.

Household expenditure is the value of household consumption, including both market purchases and imputations for consumption obtained from non-market sources, in particular the consumption of own-produced food. The expenditure calculations exclude purchases of durable goods and exceptional or one time expenses such as wedding

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expenses. The components of the household expenditure variable are explained in Table 4.2.

The expenditure data were collected over a variety of recall periods. The recall periods were two days in the case of food items, consumption of own-produced food and frequently purchased non-food items. During each visit, enumerators collected information on values of purchases or consumption since the last visit. Although coffee farmers were visited five times in 2007 and seven times in 2001, the computations of household expenditures were adjusted accordingly. For less frequently consumed products such as shoes, clothing and medicine, long recall periods (expenditures in last month, last year) were used.

Expenditures were expressed on annual basis by annualizing the data relating to shorter recall periods. The same procedure was used to compute the values of non-purchased items. The use of short recall periods in the survey for frequent purchases means that there will be seasonal effects depending on when a specific household was surveyed. However, based on the sample design, this should not affect sample means for groups of households and alter the results. Total household expenditure was calculated as the sum of all of its components after the replacement of outliers. Household food expenditure was also computed as an alternative measure of living standards. Poor households tend to spend more on food than on other goods.

Moreover, information on food prices made possible the computation of the food price indices across provinces and over time. The food price indices were used to express food expenditures in constant terms. The price information on non-food items was not available. Average provincial consumer price indices were used to adjust household

expenditures on non-food expenditures for inflation. The average provincial index is, however, not ideal for adjusting prices because there are price variations within the different provinces of Rwanda. Due to the lack of price information on non-food items across different markets in each province, the provincial price index was the best option to approximate inflation. The availability and the high quality of food price data provide another reason to use annual food expenditures per adult equivalent as a separate dependent variable.

Furthermore, adjustments for differences across households in the prices they face and the size and composition of households were made to get a standard measure of total annual household expenditure (and annual household food expenditure) per adult equivalent that can be comparable across households. Appendix 4.3 gives the scaling table that adjusts the needs of members of the household depending on their age and their sex.

The total household expenditure was computed from twenty food products and ten non-food products. These items formed respectively 66% and 48% of average expenditures on food and non–food products according to the findings from the household expenditure survey conducted in 2001. The analysis assumes that the proportion of budget shares did not vary between the two surveys that constitute the panel coffee data.

Table 4.2. Components of the household expenditure variable

Category	Additional information
Purchases of food	Data on purchases of 20 food items, based on patterns of spending over a period of 8 days for both 2001 and 2007 surveys
Consumption of owned-produced food	The valuations of owned-produced and consumed commodities were provided by respondents at prices they could be sold. Information was gathered for 19 home-grown crops.
Expenditure on purchased non-food items	Expenditures on infrequently purchased non-food items based on pattern over the last twelve months
	Expenditures on monthly purchased non-food items and services
	Expenditures on frequently purchased non-food items based on patterns in several short recall periods of two days for a total number of 8 days
Expenditure on health and education	Expenditures on education
	Expenditures on health consultations
	Expenditures on pre-natal care
	Expenditures on post-natal care
Expenditure on transfers	Money or in-kind items given away or received

The outcome variables for this study are assumed to be a function of the marketing channel chosen by farmers to sell coffee and a set of other explanatory variables. Among them are household-specific characteristics such as years of formal education completed, age and the type of the main activity of the head of the household. Other data collected are the farm size and the number of working males and females in the household, which provides the labor availability of the household. The next section describes some explanatory variables and their hypothesized effects.

4.4.2.2. Explanatory variables
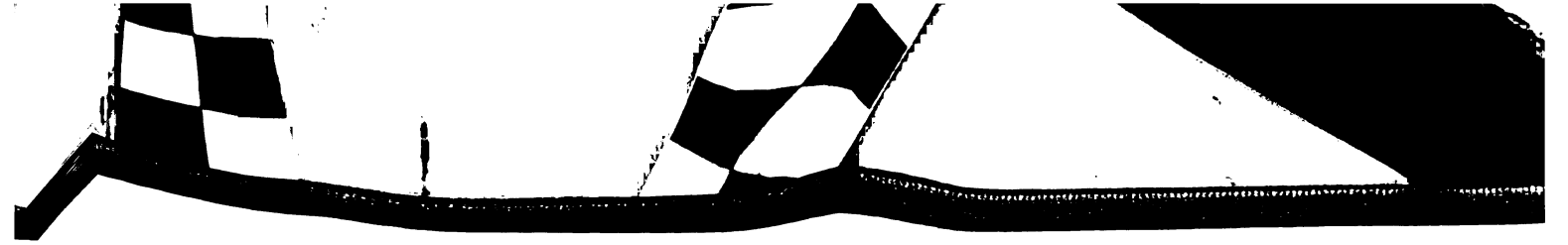
Choice of the marketing channel

The price and other benefits received by a farmer are a function of the choice of the marketing channel. Farmers selling parchment coffee receive the minimum mandated price offered by coffee traders. Farmers selling coffee cherries can choose between selling to a private or a cooperatively owned processor. Generally, farmers are often committed to sell to one processing factory because it is the only one that is nearby. In some locations, two or more washing stations are competing in the same district so farmers have to choose the washing station to which they will sell coffee cherries.

The choice of selling either coffee cherries or parchment coffee is not controlled by farmers. Coffee households that live near coffee processing facilities sell coffee cherries and get paid relatively high prices. They receive other associated benefits mentioned before and save the processing time by selling raw coffee. Coffee growers who sell parchment coffee live in places where processing facilities do not exist. It is expected that farmers selling coffee cherries are experiencing high food and total expenditures per adult equivalent.

Education

The production of high quality coffee requires farmers to adjust to the new requirements of the specialty market. Some studies have found that farmers' education plays a big role in the adoption of new agricultural practices (Zbinden and Lee, 2005). It is expected that the education levels of the heads of the households will increase their ability to respond to opportunities created by coffee reforms. Similarly, experience in

coffee production that is captured by the age of the head of the household can help coffee households adjust positively to the coffee sector reforms.

Employment

Access to multiple income generating activities can have positive effects on household income. In particular, the main occupation of the head of the household has a greater impact on household expenditures as the head of the household is supposed to meet the needs of the household. Agricultural production is the main household activity for the majority of farmers in Rwanda. Farming is more important among the poor where it accounts for more than 90%, and the majority of households do not have other employment alternatives. In 2001, only about 4.7% of Rwandan farmers were engaged in secondary activities (MINICOFIN, 2002). Using the current panel data, the number of household members engaged in secondary occupations has increased over time.
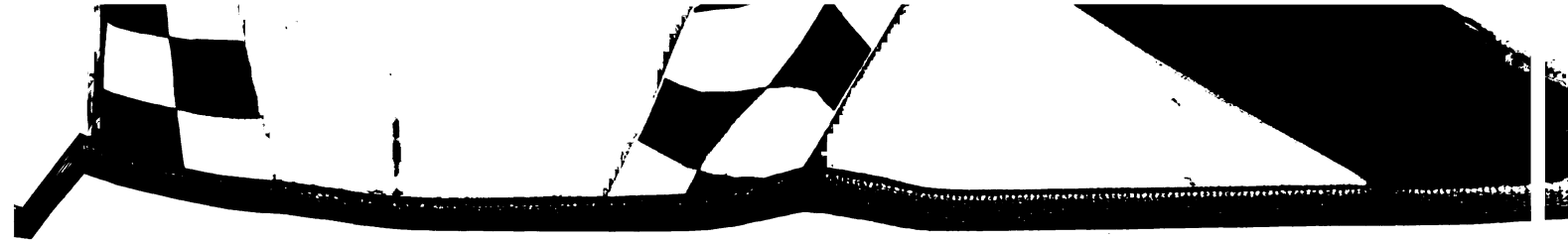
Land assets

Farmers with large farms are expected to be more flexible in land use (Chambers and Foster, 1983). They are also able to cope with risks associated with market reforms and adoption of technology (Nowak, 87). Farmers with large pieces of land can therefore better adjust resources allocated to coffee production with respect to other crop enterprises. Thus, we expect the size of land of a coffee household to have a positive impact on household income.

Labor availability

The coffee reforms introduced by the GOR aimed to target the quality coffee market. Coffee production, and in particular coffee harvesting, is labor intensive. Careful harvesting is required to produce a high quality coffee. Farmers must harvest only ripe

cherries, otherwise picking green coffee leads to a bitter coffee taste. Moreover, harvesting overripe coffee produces an inferior quality (Cleves, 95). Coffee households with enough labor availability are expected to meet the challenges of coffee production and in particular be able to produce coffee cherries of high quality. In this study the number of working men and women per adult equivalent were taken as a variable representing labor availability.

Altitude

A coffee investor takes into account the altitude at which the coffee is grown when they decide where to build a coffee processing plant because the quality of coffee produced is a function of the coffee growing altitude. High altitude leads to good quality coffee (Bacon, 2005). Coffee growing zones with a high altitude provide an incentive for coffee investors to install processing plants in these areas. Lack of variation in the altitude variable has led to its elimination from the analysis. Summary statistics of the variables included in regression analyses are given in table 4.3.
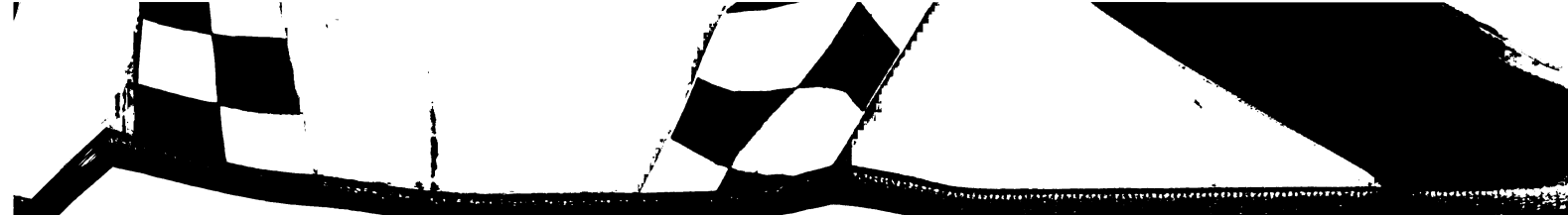
Table 4.3. Summary statistics

Variable	Description	Mean	SD
totanequ	Annual total household expenditures per adult equivalent (in FRWA)	51936.59	31467.55
logtotan	Log of annual total household expenditures per adult equivalent (in FRWA)	10.68	.64
foodadeq	Annual food household expenditures per adult equivalent (in FRWA)	40185.61	25432.9
logfood	Log of annual food household expenditures per adult equivalent (in FRWA)	10.39	.70
treatdum	Domestic coffee channels: cherry channel (1) and parchment channel (0))	NA	.46
yeardumy	Pre-reform period as 0 and post-reform period as 1	NA	.50
labormen	Ratio of total number of working males /total number of adult equivalents	.32	.23
laborwom	Ratio of total number of working females/total number of adult equivalents	.40	.21
ocuhead	Main occupation of the head of the household	611.76	71.10
sexhead1	Sex of the head of the household (1/0)	NA	.43
landpequ	Total land size (in hectares) per adult equivalent	.22	.44
agehead1	Age of the head of the household (in years)	50.11	14.75
agesquar	Age squared of the head of household	2728.45	1541.86
headclas	Highest grade level completed by the head of the household	12.68	3.95
headdipl	Highest diploma/certificate of the head of the household	81.76	37.27

NA means not apply.

4.4.3. Estimation methods

To estimate the effects of coffee policy reforms on farmers' income, results from

the random effects model are compared with findings from a fixed effects model and the

instrumental variable method. The random effects model is preferred to pooled OLS

because random effect estimates are more efficient. The random effects model relies,

however, on a strong assumption that the unobserved effect embodied in the error term of
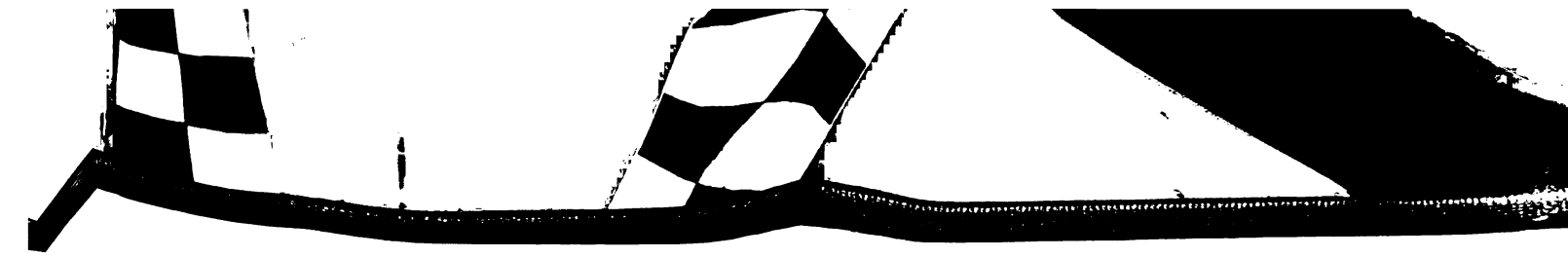
the dependent variable equation is uncorrelated with all explanatory variables (Wooldridge, 2002).

This study did not rely on this strong assumption and used the fixed effects model, i.e. the same as first difference estimations because the panel data consist of two time periods. Estimating the model using first difference or fixed effects model will, however, not eliminate the fact that the placement of washing stations, which is the condition for the cherry market, is not randomly assigned. Even if it is not easy for coffee farmers to move close to coffee processing plants due to a thin rural land market and the long lead time needed to start producing cherries, investors will build washing stations in areas where they expect a high return on their investment. To fix the endogeneity caused by the non-randomness of the choice of the coffee supply chain, the distribution of coffee growers across provinces was used as an instrument in the analysis of the effects of the coffee sector reforms on household income.

4.5. Results and discussions

Results of the regression analysis (based on random effects, fixed effects model, and instrumental variable method) are presented in tables 4.4 and 4.5. Using the random effects model, the effects of coffee sector reforms, quantified as the annual food and total household expenditures per adult equivalent, in constant prices, are positively significant for farmers selling coffee cherries compared to farmers selling parchment coffee. Coffee marketing through the coffee cherry channel increases the average annual food expenditures per adult equivalent by 20% compared to selling to the traditional parchment coffee. Similarly, selling coffee cherries improves the total annual expenditures per adult equivalent by 26% compared to selling parchment coffee.
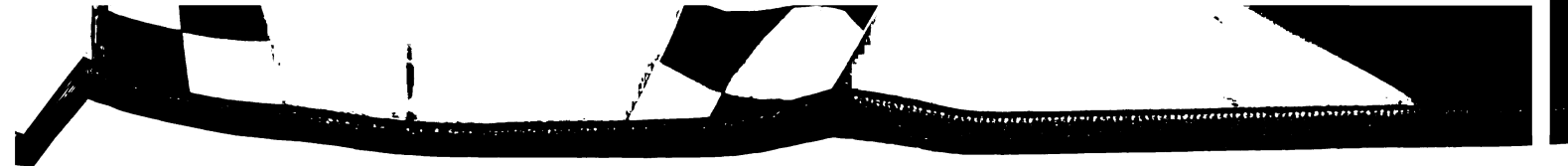
However, the use of the random effects model assumes that the unobserved effects in the error term of the regression are not correlated with all explanatory variables, which is unlikely. The fixed effects model was used to control for unobserved effects. The fixed effects model estimates are different from the random effects findings. Results from the fixed effects analysis show that farmers who are selling cherries experienced higher food and total expenditures per adult equivalent than farmers who sell parchment coffee. The coefficients of the coffee channel variables were, however, not statistically significant. These findings may be due to the time lags in terms of when farmers started selling to the coffee cherry market. Investment in coffee processing plants has not been uniform across all farmers. Some respondents may have started selling to the coffee cherry market in recent years, whereas others have been selling cherries since the early 2000s when the policy changes were introduced. The fact that farmers did not take advantage of the coffee policy changes at the same time may be one of the reasons of the non-significance of the effects of policy reforms.

To deal with the non-randomness of the placement of coffee processing plants, the share of the population of coffee growers across the former administrative provinces was used as an instrumental variable. Results from the instrumental variable method are similar with the findings from the fixed-effects model. The effects of coffee policy reforms were positive but not statistically significant. The results show that average annual food and total expenditures per adult equivalent improved over time for all coffee households but the coefficients are not significant. Coffee growers have increased the overall household expenditure compared to the period before the reforms. This indicates that even farmers who are still selling to the traditional coffee market have benefited from

the reforms. The removal of policies which obliged farmers to grow coffee has allowed farmers to efficiently allocate the limited resources and consequently improved their economic well-being.

Furthermore, food and total household expenditures are significantly higher among households with larger land holdings. Access to an additional hectare of land per capita leads to an increase of 12% and 4% in annual food expenditures and total household expenditures per adult equivalent respectively. Results obtained using the instrumental variable method also showed that households with a high number of active adult members experienced higher overall expenditures. The coefficients of the total number of men or women per adult equivalent are positive and statistically significant at the 5% level. Investment in coffee processing that followed coffee reforms in Rwanda has created employment opportunities. Owners of coffee processing plants hire a large number of people during the coffee season. The employment opportunities created by coffee reforms can contribute to increasing household income.

4.6. Conclusion

The findings of this essay show that farmers benefited from coffee reforms by increasing their expenditures although the effects of these reforms were not statistically significant. Farmers selling coffee cherries have more gained from the coffee sector reforms in comparison to farmers selling parchment coffee. Coffee growers have experienced the effects of the reforms at different times. The different time lags in terms of when farmers started selling to the coffee cherry market can justify the non-significance of the policy reform dummy variable, which tries to capture the effects of coffee policy reforms. Alternatively, another reason for these findings may be that the

time that has passed since the introduction of coffee policy reforms may not be enough to capture the effects of the policy changes. A research study that can capture when coffee growers started switching their sales from the traditional market to the coffee cherry market can well capture the effects of the coffee policy reforms on household income.

The results of this study suggest that the GOR policy of promoting the production of high quality coffee has improved food security and the overall expenditures of coffee growers. The GOR has recently removed the export tax on owners of processing facilities. These tax incentives can allow coffee investors to expand coffee processing in areas that are still selling parchment coffee. Credit incentives to enhance investment in building new processing plants could be fostered. Policies that aim to increase the number of farmers selling coffee cherries can therefore improve the economic conditions of coffee growers.

Households with access to more land are better off than others. Small-scale farmers who cannot produce enough food to meet their needs and increase coffee production need to get access to other income generating activities to improve their well-being. Policies that aim to create opportunities in non-farm employment can benefit a large proportion of coffee producers in Rwanda. Investment in coffee processing is associated with creating employment opportunities, particularly during the coffee harvest season. Increasing the number of processing plants can contribute in improving the non-farm employment in coffee intensive zones.

Finally, the minimum price setting needs to be reviewed. Results from focus groups of growers found that some farmers felt that the minimum prices fixed by the GOR do not reflect coffee production costs at the farm level. As coffee investors improve

quality coffee and establish strong marketing contracts with international coffee buyers, the GOR can still play a regulatory role in terms of quality standards but let farm gate prices be determined by market forces.

Table 4.4. Random effects, Fixed effects and Instrumental variable results for the food expenditure equation.

Dependent variable: log (annual food household expenditure per adult equivalent)						
Independent variable	Random Effects		Fixed effects		Instrumental variable	
	Coef.	Corrected Std. Err.	Coef.	Corrected standard errors	Coefficients	Corrected standard errors
treatdum	.1983**	.0872	.0391	.1174	.7950	.9250
yeardumy	.0863	.0790	.0155	.1021	.4320	.5512
labormen	.4076**	.1846	.0876	.3020	.5284**	.2224
laborwom	.1511	.1873	.0441	.2261	.1789	.1915
ocuhead	.0003	.0005	.0002	.0007	.0002	.0006
sexhead1	.0260	.0827	.0789	.2304	.0216	.1059
landpequ	.3193***	.0929	.1179	.1899	.3091***	.0659
agehead1	-.0276**	.0136	.0255	.0284	-.0336**	.0162
agesquar	.0002	.0001	.0003	.0003	.0003	.0002
headclas	.0084*	.0116	.0143	.0203	.0123	.0135
headdipl	.0002	.0009	.0003	.0013	.0010	.0015

* Significant at P = 0.10; ** Significant at P = 0.05; ***Significant at P = 0.01

Table 4.5. Random effects, Fixed effects and Instrumental variable results for the total expenditure equation

Dependent variable: log (total annual household expenditure per adult equivalent)						
Indepen dent variable	**Random Effects**		**Fixed effects**		**Instrumental variable**	
	Coef.	**Corre cted Std. Err.**	**Coefficients**	**Correct ed Std. Err.**	**Coefficients**	**Corrected Standard errors**
treatdum	.2612***	.0822	.0628	.1056	.0517	.7721
yeardumy	-.0709	.0754	.0506	.0916	.1096	.4441
labormen	.5013***	.1562	.2252	.2895	.4634**	.2067
laborwom	.4123**	.1623	.4018*	.2060	.4050**	.1715
ocuhead	.0001	.0004	.0006	.0007	.0001	.0005
sexhead1	.0615	.0745	.0868	.2073	.0918	.0972
landpequ	.2856***	.0896	.0434	.1634	.2965***	.0989
agehead1	-.0239**	.0118	-.0126	.0259	.0213	.0135
agesquar	.0002	.0001	.0001	.0003	.0002	.0001
headclas	.0169*	.0089	.0055	.0180	.0155	.0101
headdipl	.0000	.0009	.0007	.0012	.0004	.0014

* Significant at P = 0.10; ** Significant at P = 0.05; ***Significant at P = 0.01

CHAPTER 5. DISSERTATION ESSAY THREE
DOES THE ORGANISATIONAL FORM OF THE COFFEE SUPPLY CHAIN MATTER IN POVERTY REDUCTION? THE CASE OF FARMER COOPERATIVES AND PRIVATE PROCESSORS IN RWANDA

5.1. Introduction

The coffee sector has undergone substantial reforms since 2001. As part of the reforms, the GOR liberalized the sale of coffee and encouraged a policy of total quality management. For instance, the GOR is offering credit incentives to coffee investors by guaranteeing 40% of the total coffee processing investment. Moreover, export taxes were exempted for fully washed and specialty coffee (OCIR, 2002)

One of the goals of the coffee reforms was to target the expanding high quality coffee market and consequently allow coffee growers to benefit from the higher prices from this market. Rwanda started producing specialty coffee in 2002 when the PEARL project supported a pilot coffee washing station owned by a cooperative of small growers. Since then there have been some successes from other cooperatives, which have used the pilot model to sell to the high quality market segment. This has also ignited private investment in coffee processing and marketing.

Coffee cooperatives and private investors responded positively to the policy changes and the associated incentives by building new processing plants. Starting with only two washing stations operating in 2001, there were more than a hundred washing stations in 2007 (SPREAD, 2007). Building a washing station is a necessary, but not a sufficient condition to produce specialty coffee. The flavor properties of Arabica coffee bean are mostly determined at the farm level and during coffee processing stages. At the farmer level, factors such as the variety grown, altitude, soil quality, rainfall, crop practices, etc. influence the taste of coffee. Moreover, the first stage of processing is very

critical to coffee quality since cherries have to be processed seven to eight hours after harvest; otherwise the quality of coffee is negatively affected. Harvesting must be coordinated to avoid capacity problems at the washing station. Therefore, the production and marketing of high quality Arabica coffee presents problems in coordinating the supply of the quality attributes of coffee cherries with respect to demand preferences of coffee roasters and consumers (Wessen, 1998).

The production of specialty coffee is a synchronized process that requires the coordination of all stages of the coffee supply chain. Private investors own coffee processing plants but do not produce coffee cherries. The only alternative they have is to purchase coffee cherries through spot markets or through contract arrangements with farmers. The possibility of vertically integrating privately owned firms across coffee production and processing is not realistic because the Rwandan coffee industry is a small-scale enterprise and it is not feasible at this stage of Rwanda's development for growers to sell out their land to a private investor.

On the other hand, farmer cooperative plants are supplied by farmers who are members of the cooperatives. Cooperatives, organizations with close relationships with their members, are more likely to achieve the necessary vertical coordination implied by the production of specialty coffee. However, results from two quality coffee competition events organized in Rwanda in 2007 and 2008 showed that private processors can outperform cooperative processors in producing high quality. Appendices 5.1 and 5.2 show the ranking of coffee produced by cooperative and private processors during the coffee quality competition organized in those years.

The increase of investment in coffee processing took place during a period of low coffee production which resulted in high competition in the purchase of raw coffee. Due to the high competition in the coffee cherry market, processors struggled to get sufficient volume of raw coffee to meet the capacity needs of the processing infrastructure and avoid the high average fixed costs. Cases of side-trading have been reported. For instance, some members of boards of cooperatives sell coffee to private investors rather than selling it to their own coffee cooperatives (Bihogo, 2006). Cases of mismanagement of coffee cooperatives were also identified in association with a lack of business skills to efficiently manage processing plants (Bahizi, 2007).

Previous studies on cost efficiency of independent processors and cooperatives in Costa Rica found that economies of vertical integration make the cooperatives more technically efficient than private processors because cooperatives are characterized by a high degree of vertical and horizontal integration (Mosheim, 2002). Furthermore, a strong trust among cooperative members can lower the cost of monitoring for opportunistic behavior, and can explain the cooperative scale efficiency advantages over independent processors since this helps assure cooperatives a steady supply of raw coffee for processing (Spear, 2000). A similar study analyzing the effects of organizational forms on efficiency of the Indian sugar manufacturing has led to the same conclusions (Ferrantino et al., 1995). There are other findings which show, however, that as cooperatives become larger, they can face higher costs of control than conventional firms making them less scale efficient than these firms (Oustapassidis et al., 1998).

The previously mentioned advantages of cooperatives over private processors can translate into higher prices from the specialty markets and potential poverty alleviation
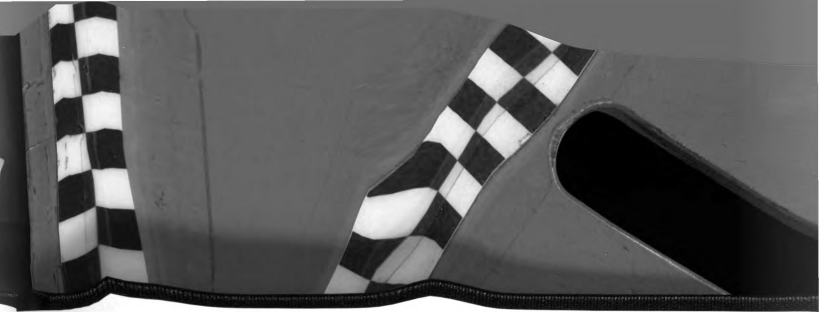
for cooperative members. However, the research on impact of organizational forms on efficiency fails to quantify how these efficiency differences are translated into economic impacts at the farm level. Furthermore, the competitive nature of the coffee cherry market in Rwanda is interesting in the sense that growers choose coffee buyers based on prices and other services, and benefits provided rather than being a member of a coffee cooperative.

Policy reforms combined with insufficient raw coffee created intense domestic supply competition in the coffee cherry market. These features of the Rwandan coffee cherry market form a special case which can broaden the existing knowledge of how different supply chain arrangements operate in a developing country context. The current study aims to compare the effects of the two organizational forms on household expenditures, a proxy of household income, in the special context of coffee cherry competition.

As coffee farmers sell cherries to the two organizational forms, comparing the economic effects of the two channels on farmers is also important to economic development policy. The development community, aid agencies and governments are currently expecting hard evidence on the impact of interventions. Evaluations that provide qualitative assessment and fail to identify measurable outcomes are seen to be incomplete (Ravallion, 2005). The study assesses quantitatively which supply chain has benefited coffee growers the most.

The outline of this paper is structured as follows. The second section is devoted to explaining the organization of the coffee cherry market in Rwanda. The third section describes the two organizational supply chains (coffee cooperatives and private

processors) and their expected impacts on farmer income. The fourth section presents the conceptual framework of the study. The fifth section contains the survey design, the description of data and estimation methods. The sixth section discusses the results of the study. Finally, the last part presents the main conclusions of this essay and policy recommendations.

5.2. Organization of the coffee cherry market

Coffee farmers sell coffee cherries to either farmer cooperatives or individual processors. Farmer cooperatives are associations of small farmers, and their creation has been promoted by the government to facilitate implementation of coffee policies. Rwanda counts around 30 coffee farmer cooperatives that are owned by more than 50,000 farm families. Cooperative investment is owned by farmers and these elect a board among themselves. The president of the board manages the coffee processing plant in collaboration with members of the board (SPREAD, 2007).

The liberalization of coffee marketing, along with greater opportunities in the international market have created an environment favorable to investment in coffee processing. Development organization agencies have worked with coffee processors and trained them in high quality coffee production techniques. In particular, USAID projects have supported the coffee sector by providing necessary training to produce and export high quality coffee. The PEARL and ACDI-VOCA projects focused their activities in helping farmer cooperatives whereas the ADAR project provided technical assistance to private entrepreneurs willing to invest in value-added initiatives including coffee.

In Rwanda, both farmer cooperatives and individual processors process coffee to sell in the international market because domestic coffee consumption is negligible. The

specialty coffee is produced in washing stations owned by either cooperatives or private processors but the majority of processing plants is owned by individual processors. In 2007, 2,500 tons of specialty coffees were produced from 101 functional washing stations (SPREAD, 2007). Appendix 5.3 shows the trends in the production of specialty coffee since 2002. The low figure of 2007 was mainly due to overall shortage in coffee production.

Every year, the government publishes minimum prices that coffee processors must pay farmers for the raw coffee. Farmers get paid for the coffee they deliver to processing plants or cherry collection centers. Some farmers are paid immediately after coffee deliveries if the processors have cash in hand or wait until processors have available cash. Due to strong competition in the raw coffee market, many processors, particularly private processors, immediately pay farmers when they supply cherries. Farmers also get extension services in addition to payments for raw coffee. They also receive credit including school, food and cash loans that are expected to be paid back through the sales of coffee cherries during the harvest season.

Owners of processing plants get operating loans from Rwandan banks. This capital is used to buy cherries and finance other costs related to coffee processing and marketing. Loans are reimbursed from proceeds of coffee sales. Due to managerial and financial weaknesses of cooperatives, many of them experience cash flow problems. As a consequence, farmer members tend to sell cherries to private processors unless there is no alternative coffee buyer nearby or if they are very committed to their cooperatives.

Although the liberalization of coffee marketing in Rwanda allowed private investment in coffee processing, this happened during a period of low coffee production

as farmers were no longer interested in investing in coffee production due to low bulk coffee prices. Moreover, under liberalization they were not obliged to undertake agricultural coffee practices which lead to high coffee yields. The supply response to high prices offered by the emerging coffee cherry market has not yet materialized as new planted coffee trees require three to five years before they can start producing. Therefore, coffee processing plants operate under capacity and do not take advantage of scale economies leading to cost inefficiencies.

5.3. Organizational forms of the coffee supply chains (Coffee cooperatives and private processors)

This section briefly discusses how the two organizational forms (private and cooperative processors) may affect income of farmers who are supplying raw coffee to processing plants. This is a key variable as the main research question in this study is whether the type of coffee supply chain matters in explaining differences in household expenditures of farmers.

Coffee cooperatives in Rwanda form a vertically integrated supply chain as they get involved in all activities related to coffee production, processing and marketing. They also provide production inputs such as fertilizers and pesticides needed by coffee growers which have to be reimbursed from coffee sales. Private processors rely on the supply of raw coffee by farmers as many do not own coffee farms or plantations. Private processors carry out the processing and marketing of coffee but have little say about the production of raw coffee. Some coffee processors offer, however, credit inputs needed by farmers in their coffee farms. These inputs offered are paid back from sales of cherries during the harvest season.

Cooperatives and private processors have two different economic objectives: cooperatives aim to maximize profits per member whereas the objective function of private processors is to maximize the overall financial profit (Mosheim, 2002). While the income received by stockholders of an investor-owned firm (IOF) depends on the financial profitability of the investment, the income of a cooperative stockholder will depend more on the prices they receive and the types of services and benefits offered by cooperatives.

Staatz (1984) has argued that regardless of the objective function aimed by the two organizational forms, structural characteristics of cooperatives will make them to behave differently from private investors. These characteristics include the patron-stockholder identity, the distribution of ownership benefits through patronage and the governance of farmer cooperatives. This section will briefly revisit some of the behavioral differences of the two coffee supply chains and develop hypotheses about their impact on farmers' benefits. The benefits received by farmers who sell coffee to the two types of supply chains are proxied by household expenditures (food and total expenditures) per adult equivalent.

5.3.1. Diversification and availability of capital

Cooperatives in Rwanda are owned by members who have little stake in their organization. Many cooperative processing plants have been heavily subsidized by the government and NGOs. The only way to raise additional equity is to invest profits generated from coffee sales. However, profits are low due to high costs experienced by processors associated with low volumes of raw coffee, which do not allow them to

exploit economies of scale. Moreover, since farmers did not invest in the coffee processing facilities, they undervalue this investment.

On the other hand, although the government provided credit incentives to invest in coffee processing, coffee investors had to contribute up to 60% of the total investment. Many of them received loans from local banks to undertake the investment. Private processors' goal is to maximize the return on capital invested and be able to pay back the loan. To achieve this, they try to attract farmers by providing more benefits than the cooperative processor counterparts. Farmers will tend to supply more coffee cherries to private processors than to cooperative processing plans because of these incentives. Discussions with farmers show that cooperatives cannot match the liquidity capabilities of private processors.

The majority of private processors also diversify into unrelated markets. This allows them to move capital across different markets and this constitutes a competitive advantage. They can therefore use money from other investments to finance operating costs in coffee processing such as buying cherries. A study that examined the role of owners and managers in affecting agribusiness cooperatives and investor-owned firms, found that investor-owned agribusiness firms that diversify into unrelated markets achieve a high level of performance (Katz, 1997). The diversification into other sectors also makes economic sense given the business cycle of coffee. The coffee harvest season goes from April to July and the coffee processing equipment is not used for the rest of the year.

The diversification into other business lines by private processors is also related to their capacity to access investment funds. Private processors easily get loans at market

rates because they have collateral. Coffee farmer cooperatives have less collateral. Banks are reluctant to give loans to cooperatives for fear of loan default. Some cooperatives still have access to loans, thanks to RWASHOSCA, a coffee marketing and export company owned by 16 cooperatives. RWASHOSCA works with banks to facilitate access to operating capital by cooperatives.

The fact that cooperatives that belong to RWASHOSCA have captured higher international prices than other coffee processors may be due to the availability of liquidity that allowed their cooperatives to provide adequate benefits to farmers. In addition, the company has been financially supported by different NGOs. A similar successful story was reported in Costa Rica, where a German NGO worked closely with farmer cooperatives and helps them sell coffee at high prices (Mosheim, 2002). Without such support, cooperatives are limited in terms of generating needed capital to carry out activities related to processing and marketing.

5.3.2. Flow of information between farmers and owners of coffee processing factories

Cooperatives have been an important instrument for development and have been used as an enabling organization of small farmers to compete in the presence of market and institution failures (Bijman et al., 2005). With the current situation of globalization of food and agricultural markets, characterized by the liberalization of markets (reduction of market protection and subsidies) and stringent consumer demands (quality, safety, convenience), agricultural markets are becoming less commodity or product-oriented and more customer oriented where the latter is requesting a specific product at a specific place and time. These new market conditions imply increasing vertical coordination among all participants of the chain from retailers to producers.

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Cooperatives, organizations with close relationships with their members, are more likely to achieve the necessary vertical coordination implied by the new market conditions than IOFs (Royer, 1995). In comparison with IOFs, cooperatives face a low cost of monitoring due to a high level of intensity of control and a managed coordination characterized by mutual interest, long-term relationships, shared benefits, open information sharing and stability, interdependence among members (Peterson et al. 2001). This flow of information is necessary to produce specialty coffee because the whole supply chain from the farm level to the processing stage has to be carried out properly to avoid problems with coffee taste.

The patron-stockholder relationships can lead to behavioral differences between cooperative and IOFs' supply chains and present potential differences between the two organizational forms with respect to the quality of goods they produce (Staatz, 1984). Since members of cooperatives are also stockholders, there is a better flow of information about the expected quality of coffee the processor wants to sell between the management staff of the cooperative processing plant and farmers who deliver raw coffee to the processing plant. Moreover, farmers are more likely to make the necessary effort in the production of coffee that leads to the required quality of raw coffee because as stockholders, they have an incentive to make their organization profitable. By doing so, they expect their cooperative to generate high profits, which will be repaid in the form of dividends. On the other hand, growers who are supplying cherries to private processors may present opportunistic behavior in their effort to produce and sell coffee to them because profits generated by private washing stations go to the owner of the plants.

Although the literature on behavioral differences between farmers supplying coffee to cooperatives and private processors discussed above predicts the superiority of cooperatives in terms of producing high quality, results from the coffee quality competition organized in 2007 and 2008 were not consistent with the predictions. Results did not show a consistent pattern of the quality advantage of cooperative plants. Some private processors have sometimes performed much better than cooperative processors.

5.3.3. Decision making in the two organizational forms and its impact on transaction costs

Due to intense competition in the cherry market, some processors, particularly private processors, pay above minimum prices set by the government to attract sufficient volume of raw coffee. Discussions with coffee stakeholders including farmers reveal that cooperatives are less able to respond quickly to price changes initiated by private processors. Since cooperatives in Rwanda delegate greater decision making authority to the board of directors, a price adjustment has to be discussed. Moreover, the president of the board, who is managing the daily operations of the processing plant, has to build a consensus with other members and find the best way to respond to price changes initiated by private processors that operate in the same coffee zone. Sometimes, a general assembly may be necessary to discuss the price setting of competing processors. This process of reacting to price setting behavior of other processors by cooperatives results in high transaction costs. Cooperatives are considering mechanisms to delegate greater authority to managers of cooperatives instead of boards of directors.

5.3.4. Limited managerial skills of the board of directors of farmer cooperatives

Coffee processing and marketing operations are complex activities that require skilled managers. Most members of boards of directors of farmer cooperatives lack expertise in basic management and some of them are illiterate. This results in poor management of cooperatives and a high turnover of leadership positions. Improving managerial skills has been the focus of NGOs supporting cooperatives in Rwanda. However, despite a heavy investment in capacity building of cooperatives, they are still very fragile and dysfunctional (SPREAD, 2007).

A study conducted in Kenya found that a lack of a general understanding among the membership of the business of running a cooperative in terms of management, accounting and marketing skills necessary to compete effectively was the major cause of cooperatives' failures (Nyoro et al., 2005). Based on the discussion about structural differences between cooperative and private processors and their behavioral consequences, some characteristics of the supply chain may be beneficial for the cooperative and its members to sell to the specialty market; others put private processors at a competitive advantage in the face of a highly competitive cherry market. The effects of the choice of the supply chain on coffee growers in terms of household expenditures will therefore depend on the relative importance of the different structural differences of the two supply chains and how farmers respond to them.

5.4. Conceptual framework

The liberalization of coffee marketing in Rwanda has encouraged investment in coffee processing by farmer cooperatives and private investors. Many washing stations have been built since 2001 but have faced low coffee production, resulting in high

operating costs. Farmers can sell cherries or parchment coffee. Selling coffee cherries offers more benefits to farmers compared to selling parchment coffee because farmers who sell cherries often get paid promptly, with relatively high prices. These farmers also avoid costs associated with primary coffee processing. Farmers who sell parchment coffee tend to be located in places where access to processing plants is difficult.

In many places, two or three processing plants compete in buying coffee cherries. It has been reported that members of farmer cooperatives are not committed to their organizations in the sense that even some members of the board of directors of some cooperatives often sell cherries to competing private plants. If a farmer is faced with making a choice of a buyer, his choice will be based on the maximization of an underlying utility function. The actual utility level of each farmer is, however, unknown.

This study adapts the utility maximization framework applied to coffee growers in Costa Rica (Wollni et al., 2007). The farmers' utility function that we can observe is expressed as a function of the choice of the supply chain (supply$_i$), a vector of exogenous variables X_i and a vector of parameters to be estimated, β. The household's utility is estimated in the form of a household expenditure equation: $E_i = X_i \ \beta + \gamma \ supply_i + \varepsilon_i$.

In this framework, the observable portion of the expected utility function is assumed to be equal to the mean of the random variable E_i. The unobserved portion of the farmers' utility is represented by the error term ε_i. Contrary to Wollni et al.'s study, in this study, the error term ε_i is not assumed to be independently and identically

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distributed with mean zero. The farmer will choose to sell cherries to a specific coffee processor if benefits derived from selling to the chosen processor are greater than benefits offered by other competing plants. Moreover, the prices of cherries are fixed by the government and all processors pay at least the government mandated prices. There are, therefore, unobserved characteristics that will make the farmer choose one buyer instead of the other. The variable supply$_i$ is assumed to be endogenous. These are selectivity issues that the specific model will have to address to assess the effects of the choice of the coffee supply chain on household income.

5.5. Data and estimation methods

5.5.1. Survey design

Data for this study were collected through a household survey conducted in 2001 and 2007. In 2007, a survey of 252 coffee farmers were identified from a large random sample of 6400 farmers conducted in 2001 by the MINICOFIN. The large sample included coffee farmers (498) as well as non-coffee farmers. The survey forms the panel data as the selected coffee growers who were respondents in the 2001 survey were revisited in 2007.

From the 252 respondents, 148 farmers who sell coffee cherries to processing plants were chosen for this study. Among them, 59 farmers are members of cooperative processors and 89 farmers sell raw coffee to private processors. The number of cooperative processors and private processors are respectively 12 and 21. A short version of the 2001 questionnaire was constructed to collect information on household expenditures of goods and services that have high budget shares and other variables.

5.5.2. Description of data

5.5.2.1. Dependent variables

The study used annual food and total household expenditures per adult equivalent (FRWA) as dependent variables. These variables are proxies of household income. Household expenditure is the value of household consumption, including both market purchases and the consumption of owned-produced food. Although these expenditures were not derived from all goods and services consumed by respondents, they include goods and services with high budget shares. Appendices 4.1 and 4.2 give the types of items and their respective budget shares.

5.5.2.2. Explanatory variables

The dependent variables are expected to be a function of the organizational type of the coffee supply chain (cooperative or private), where farmers sell raw coffee and other control variables. These include the degree of competition the cooperative and private processors face while competing to purchase cherries, the location of the processing plants, loyalty of coffee growers to sell cherries to their cooperatives, experience in coffee processing and household characteristics. Household socio-characteristic variables include farm size, labor availability, the education level and the age of the head of the household. The hypothesized effect of the different variables is derived from the literature reviewed below.

Level of competition faced by processors in the raw coffee market

As mentioned before, the coffee reforms have allowed increased private investment in coffee processing. Processing plants were, however, constructed during a period of low coffee production. This meant that the installed capacity in these plants was greater than coffee production. Processors compete in buying coffee cherries to fill the capacity of their plants. Previous studies that compared the performance of farmer cooperatives and IOF have found that competition was negatively related to technical, allocative and cost efficiencies (Zhang et al, 2001; Mosheim, 2002). In his recent study, Mosheim (2008) found that cooperatives that operate in a competitive environment have a high probability of not giving high dividends to farmers.

While the competition among processors can lead to losses in their cost efficiencies, this does not necessarily translate in loss of benefits obtained by farmers. High competition may push processors to pay high prices and offer many benefits as they compete for raw coffee. On the other hand, more competition might oblige coffee processors to carry expensive searches for raw coffee to fill the capacity of their plants resulting in high costs (Mosheim, 2008). By doing so, they may not be able to provide cash incentives to farmers. The effect of competition on households' income can therefore be positive or negative.

An index is constructed to capture the competitive pressure cooperative and private investors face when buying cherries in Rwanda. The index takes into account the number of processors operating in a given district. This index is adapted from indices constructed by Herfindahl-Hirschman and Mosheim (2008) which were computed by taking into account the number of competing buyers and their market share. This study

did not have available data on market shares of the different processors. For a given

number of private and cooperative processors operating in a given district, the

competition index (c_i) is defined as $c_i = N_i/ (N_i + 1)$ where N_i is the total number of

cooperatives and private processors competing for cherries in the same district[2].

Loyalty of producers

Farmers' commitment to their organizations is evident if farmers continue to

supply raw coffee to their coffee processing plants even if other alternative buyers, i.e.

individual processors buy cherries and offer other benefits to farmers on more favorable

terms. Farmers' loyalty helps processing plants to project coffee that will be processed

and facilitates planning of activities such as hiring labor during the coffee season.

Farmers will stick to their organization if the rate of return on members' investment is

relatively high. This rate of return has two components: the return of capital and the

return on capital (Gittinger, 1982). The return of capital is the recovery of the initial

investment and the return on capital represents additional net earnings that will be created

by the investment. Investment in coffee processing by many farmer cooperatives has

been heavily subsidized by the GOR and donor agencies. Farmers did not contribute
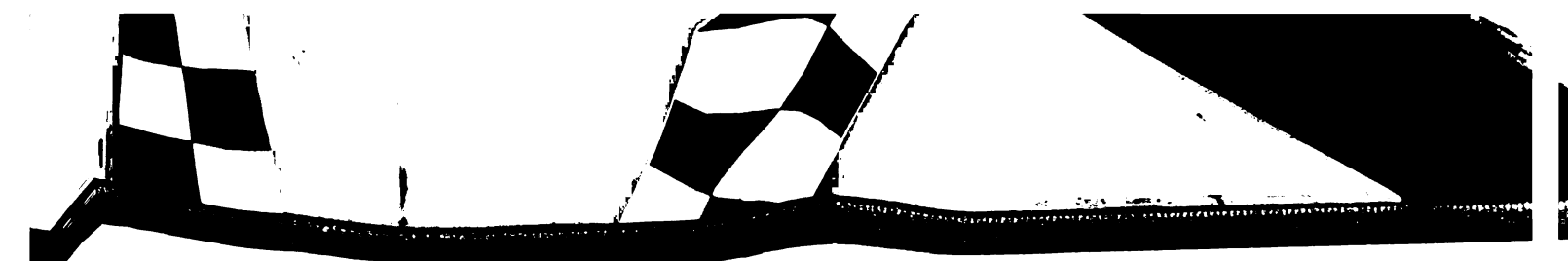
much in the cost of setting up processing plants.

Many members of cooperatives decide to sell cherries to private processors

because they have nothing to lose if their cooperatives do not perform well as long as

there are other alternative buyers. Because of the low commitment of farmers to their

organization, cooperative processing plants do not get enough volume of raw coffee to

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[2] Cooperatives in Rwanda do not respect each other's territory as is the case in Costa Rica documented by Mosheim (2008)

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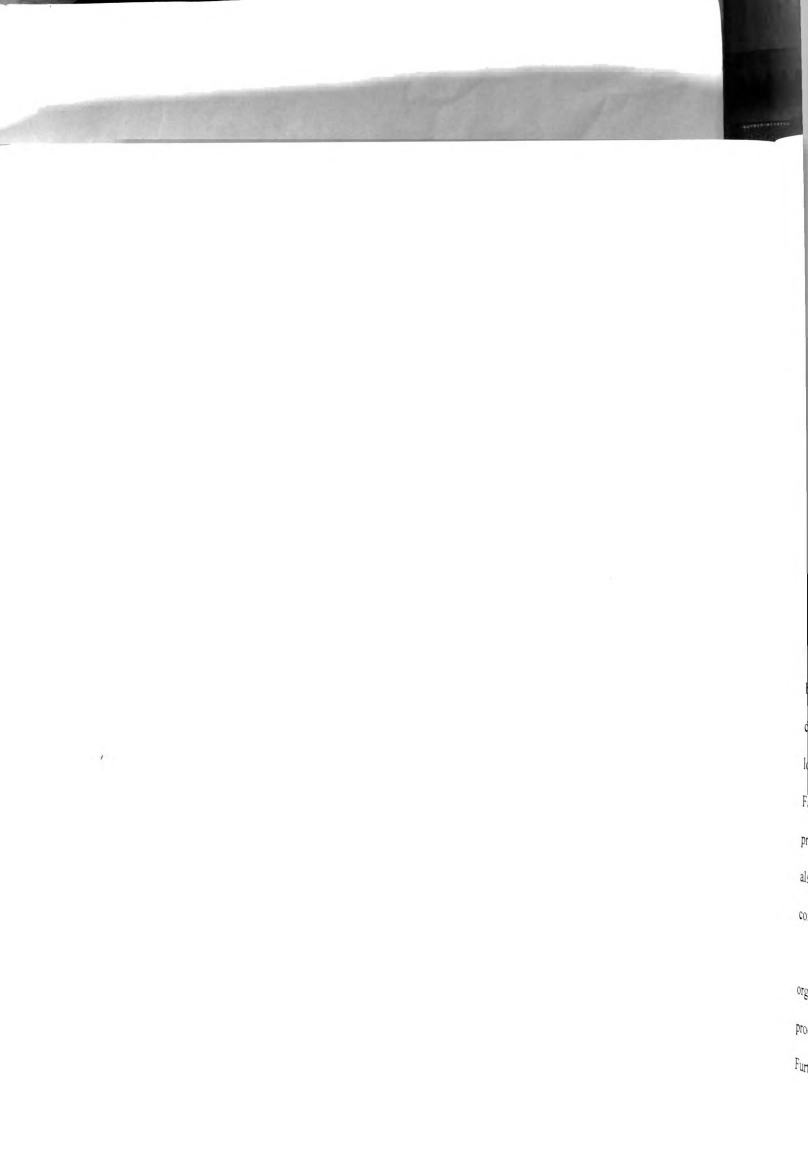
achieve economies of scale and lower production costs. The lack of commitment of farmers, combined with a general decline in total coffee production, has made cooperatives incur high operating costs. The high cost structure of cooperatives does not allow them to match the financial benefits provided by private processors and to generate profits that can enable them to offer dividends to their members.

The lack of loyalty of cooperative members is accentuated by the open-membership policy of cooperatives. Loyalty of members will be low when it is not costly to exit the organization. Although farmers have to pay a symbolic amount to be a member of a cooperative, the cost of exit does not exist. Farmers can decide to exit the organization without any charge. The open-membership principle can affect negatively the viability of cooperatives (Staatz, 1984).

Farmers do not also base their patronage to prices paid by processing plants because prices are set by the government. Unless there is only one buyer nearby, the choice of where to sell coffee is influenced by other financial benefits such as school loans, in-kind loans such as food, cash credit, etc. offered by the different buyers. Farmers reported that they received more benefits when they sell coffee to private processors than selling to cooperative plants (SPREAD, 2007). The same situation was also found in Costa Rica where private entrepreneurs are able to provide large cash loans compared to cooperatives (Mosheim, 2008).

The previous discussion highlights the lack of farmers' commitment to their organization and puts cooperatives at a competitive disadvantage because private processors are more likely to provide economic incentives than farmer cooperatives. Furthermore, the competition in the raw coffee market discussed above put pressure on

cooperatives to match the benefits offered by private investors because loyalty is not automatic.

Education and the age of the head of the household

Although it is not easy to measure farmers' commitment to their organizations, some studies have found that old farmers tend to be more loyal to their cooperatives than young farmers. Similarly, farmers who have reached a certain age are more likely to be trusted by buyers and be offered economic incentives and loans because they are more likely to pay back loans.

It is also expected that education of the head of the household can play a big role in terms of responding to market incentives offered by the two supply chains. Some studies have also shown that the level of education of farmers plays a big role in their ability to respond to new agricultural practices (Zbinden and Lee, 2005).

Farm size

Coffee farmers with large land assets are more likely to experience high expenditures. These farmers can adjust easily the land reserved for coffee with respect to other crops (Chambers and Foster, 1983) resulting in high expenditures regardless of what type of organizational form to which they sell cherries.

Labor availability

Coffee processors that buy coffee cherries are targeting the high quality market. Coffee production in general and coffee harvesting in particular that are necessary to meet the requirements of this market are labor intensive. For instance, coffee harvesting has to be carried out at the right moment because overripe cherries lead to low quality (Clever, 95). After harvesting, cherries go through a triage to remove unripe and bad

quality cherries. To produce high quality coffee, processors follow rigorous processing procedures where unripe and bad quality cherries are rejected at the coffee washing station or the coffee cherry assembly center. Therefore, farmers have incentives to undertake all these activities; otherwise their cherries risk being rejected. This process requires substantial labor.

Furthermore, results from the panel data show that the total number of working men and women engaged in secondary activities has increased in 2007 compared to 2001 when investments in coffee processing started. Households with high labor availability are therefore expected to earn high income from other activities besides coffee farming.

Choice of supply chain

There are many factors that determine the choice of the coffee buyer by farmers. They include how much trust farmers owe to the manager or the owner of the processing plant, and how the processor responds to the needs of the supplying farmers. These needs include extension services, inputs needed in coffee production practices such as fertilizers and pesticides, and cash credit. Discussions with farmers confirm that owners of coffee processing plants use a set of incentives to attract farmers to sell cherries to their plants. A discussion of how behavioral differences between cooperatives and private processors can affect the benefits received by farmers was presented in section 2.

Coffee growers sell cherries to either a private or a farmer cooperative processor. In few places where there exists a unique processing plant, farmers deliver cherries to that factory. If two or more processors are operating in the same coffee zone, growers make a choice of where to sell based on incentives they expect to receive from processors. Although the government sets minimum prices, the choice of supply chain is

influenced by the expected benefits offered by processors, thus resulting in endogeneity. To deal with this problem, an instrumental variable method is used. The section on estimation methods will elaborate more on the choice of the instrumental variable for this chapter. The summary statistics for the variables included in the regression analysis are given in table 5.1.

Table 5.1. Summary statistics

Variable	Description	Mean	SD
totanequ	Total household expenditures per adult equivalent (in FRWA)	55159.24	30651.41
logtotanequ	Log of total household expenditures per adult equivalent (in FRWA)	10.76	.59
foodadeq	Food household expenditures per adult equivalent (in FRWA)	41964.09	23939.68
logfoodadeq	Log of food household expenditures per adult equivalent (in FRWA)	10.45	.68
suplych	Dummy variable for the type of supply chain (cooperative == 1 and private ==0)	N/A	.48
yeardumy	Pre-reform period as 0 and post-reform period as 1	N/A	.50
labormen	Ratio of total number of working males /total number of adult equivalents	.31	.21
laborwom	Ratio of total number of working females/total number of adult equivalents	.38	.19
ocuhead	Main occupation of the head of the household	616.10	63.18
sexhead1	Sex of the head of the household (1/0)	N/A	.39
landpequ	Total land size (in hectares) per adult equivalent	.22	.31
agehead1	Age of the head of the household (years)	49.56	13.72
agesquar	Age squared of the head of household	2644.3	1397.50
headclas	Highest grade level completed by the head of the household	12.81	3.67
headdipl	Highest diploma/certificate of the head of the household	79.11	39.43
compind	Competition index	.68	.12

N/A means not apply.

5.5.3. Estimation methods

In estimating the effects of the role of coffee supply chains on household income, this study assumes that the choice of the coffee cherry buyer is an endogenous explanatory variable. In places where two or more processors compete for raw coffee, the decision to sell to one processor instead of the other is assumed to correlated with other characteristics that may affect the expected benefits offered by the processor. The benefits received by farmers from the coffee buyer will most likely affect household expenditures, resulting in a self-selection problem.

In this situation, estimating the effects of the choice of the supply chain by OLS will result in biased estimates because the choice of the coffee buyer (the endogenous variable) and the regression error term are correlated. One way to solve the self-selection problem is to use the IV estimation method if a good instrument can be found. The walking time (in minutes) traveled by farmers to sell cherries can theoretically serve as an instrument for the endogenous variable. The walking distance is thought to be correlated with the choice of the supply chain because farmers will avoid walking long distances because all coffee processors buy cherries at least at the mandated prices set by the government. In other words, farmers are assumed to sell cherries to their closest coffee processing plant.

Furthermore, the walking distance is also assumed to be uncorrelated with any other factors that can affect household expenditures, the dependent variable. Since the assumed endogenous variable is a binary variable, probit estimation of the reduced form equation that include the walking distance variable was done to test whether walking distance is correlated with the type of the coffee supply chain. The walking time was

strongly associated with the choice of the coffee buyer at a 1% level of significance but uncorrelated with the dependent variables. After removing the unobserved effects through first differencing, the instrumental variable method was used to identify the effects of the organizational form of the supply chain on household income.

5.6. Discussion of results

Results from the regression analysis based on the combination of instrumental variable method and the first differencing on the two year panel data are presented in tables 5.2 and 5.3.

The effects of the coffee supply chain (cooperative or private) by coffee growers on annual food and total household expenditures per adult equivalent are not significant. There is therefore no indication that farmers who sell to cooperative processing factories get more benefits than farmers selling to private processing plants or vice-versa.

This is an interesting result for development policy. Despite heavy investment in helping farmer cooperatives access the specialty coffee market, private processors are able to compete and sometimes offer better services and benefits to coffee growers compared to cooperatives.

Table 5.2. First differencing and Instrumental variable (IV) method's results from the food expenditure equation

Dependent variable: log (annual food household expenditure per adult equivalent)		
Independent variable	Results	
	Coefficients	Corrected standards errors
suplych	.7506	.5696
yeardumy	.0663	.0899
labormen	.5068**	.2517
laborwom	.3571	.3254
compind	.7105	1.2674
ocuhead	.0004	.0004
sexhead1	.0079	.1278
landpequ	.5109***	.1255
agehead1	-.0408*	.0224
agesquar	.0003	.0002
headclas	.0048	.0138
headdipl	.0006	.0012

* Significant at P = 0.10; ** Significant at P = 0.05; ***Significant at P = 0.01

Table 5.3. First differencing and Instrumental variable (IV) method's results from the total expenditure equation

Dependent variable: log (total annual household expenditure per adult equivalent)		
Independent variable	Results	
	Coefficients	Corrected standards errors
suplych	.4105	.4629
yeardumy	.1396*	.0733
labormen	.5622***	.2002
laborwom	.6190**	.2656
compind	.2977	1.010
ocuhead	.0001	.0004
sexhead1	-.0905	.1068
landpequ	.4291***	.1196
agehead1	-.0330	.0201
agesquar	.0002	.0002
headclas	.0011	.0106
headdipl	-.0007	.0011

* Significant at P = 0.10; ** Significant at P = 0.05; ***Significant at P = 0.01

During the early years of coffee reforms, there may have been some economic justification for the GOR and the NGOs to support coffee cooperatives and train them how to produce high quality coffee and sell it to the specialty coffee market. Working with cooperatives to introduce the new technology of producing high quality coffee may be cost effective during the early stages of the technology transfer. However, as more farmers have adopted the required practices to sell to the new market and as the coffee industry has been stabilized and more private investment was done, there is less need for NGOs to financially support cooperatives. The role of NGOs should be directed towards strengthening the national coffee agency, which is in charge of setting coffee policies and regulating the coordination of the coffee industry.

Holding constant the type of supply chain and other variables, the farm size has a significant and positive effect on household expenditures. The access to an additional unit of land per adult equivalent significantly increases annual food household expenditures and total household expenditures per adult equivalent. Households with access to more land are more likely to get cash loans and other benefits from the different coffee processing chains, thus helping them to smooth their consumption. Farmers with more land resources are also more likely to own many coffee trees. For a farmer to get access to a loan from coffee processors, an extension agent visits the farmer and tours his farm to assess his ability to reimburse the loans through selling cherries during the harvest season. Farmers with a large amount of land are relatively well suited to comply with the requirements set by the different coffee processors when they request cash advances and other forms of credit.

The empirical result of this study on the role of farm size is also consistent with another study that looked at factors that influenced the performance of coffee processing cooperatives in Costa Rica. The study found that the elasticity of profit per member (or dividend) was positively associated with the farm size (Mosheim, 2008).

The discussion of structural differences between cooperatives and private processors has highlighted advantages of private processors in attracting a high volume of raw coffee compared to cooperatives. Moreover, the lack of loyalty of farmers to their organization does not allow cooperatives to attain economies of scale. The lack of cooperative spirit and commitment of farmers to their organization make them experience high operating costs and can explain their inability to provide more benefits to farmers relative to private processors.

Some specialty coffee channels put cooperatives at a competitive advantage to sell at relatively high prices. For instance, only farmer cooperatives can sell to the fair trade coffee market but private processors are not allowed to sell coffee at fair trade prices. The coffee quality competition organized in 2007 and 2008 has shown, however, that some private processors can perform well compared to farmer cooperatives in producing specialty coffee. They can therefore capture above fair trade prices by targeting high quality-conscious coffee buyers.

The competition among coffee processors was not a significant factor in explaining household expenditures of farmers supplying cherries to cooperative and private processors. The analysis showed, however, an expected sign of the role of competition on household expenditures. The coefficient of the competition index variable is positive, but insignificant, at a 10% level. The less monopsony power cooperatives and

private processors have, the better it will be for coffee growers to realize high expenditures.

As stated before, the main area of competition between coffee processors is found at the level of raw coffee marketing. This competition is accentuated because coffee production has been stagnant in a period of increasing investment in coffee processing which leads to excess capacity. More competition might put processors under pressure to fill the processing capacity. As a consequence, they may undertake expensive searches for cherries by offering many benefits and other incentives to farmers selling raw coffee. The high competition among coffee processors can result, however, in high operating costs. This high cost structure can in the long run, result in few benefits offered to farmers.

5.7. Conclusions and policy recommendations.

The results of the study show that there is no indication that farmers benefit from selling to coffee processing cooperatives instead of selling to private supply chains or vice-versa. These findings suggest that, although the structure of some specialty coffee channels, such as the fair trade market, put cooperatives at a competitive advantage, private processors are able to compete with cooperatives and some times offer strong incentives to farmers. Although other benefits offered by cooperative organizations may not have been captured in this study, the results question the cost-effectiveness of government programs and international organization agencies that invested heavily in supporting coffee cooperatives to access the specialty coffee markets. The study shows that farmers who sell raw coffee to private processors are not worse off than farmers selling to cooperative processing plants. Private processors who do not need the same

level of support given to farmer cooperatives can match benefits received by the cooperatives' members.

The competition in the raw coffee market that followed coffee sector reforms presents intended consequences at the farm level but can, however, jeopardize the sustainability of the coffee industry. The results of the study show that the presence of many processing plants competing for the limited volume of raw coffee may be positively associated with high household expenditures. This may be due to high benefits given to famers by processors in their search for raw coffee to fill the processing capacity.

In the current conditions of low coffee production and the excess capacity of coffee processing plants, more benefits given to farmers can result in high cost structure of coffee processing. A high cost structure may not allow them to continue offering better services and benefits to farmers. Cost inefficiencies of coffee processors could jeopardize the long-term sustainability of the domestic coffee cherry market.

The above discussion has pointed out some of the weaknesses of farmer cooperatives in Rwanda. Their main problems are the lack of managerial and marketing skills within the many boards of directors which run the daily activities of the processing plants. This is accentuated by a lack of loyalty of farmers to their associations, which benefits private processors. Private processors are financially capable of offering better benefits to farmers. The possibility of a cooperative-private partnership can solve the weaknesses encountered in cooperatives in Rwanda. Private investors can bring the management skills to the partnership and manage the plant to their benefit and to the interests of farmers who supply coffee to the plant. If farmers can have a share in the

private investment, both farmers and investor will have an incentive to increase the return on their investment. An in-depth analysis of case studies that highlight how private processors work closely with farmer cooperatives in Rwanda can shed some light on how to improve the performance of the coffee sector.

CHAPTER 6

CONCLUSIONS AND POLICY IMPLICATIONS

The current strategy of the Ministry of Agriculture, which is part of the National Agricultural Policy and the National Poverty Reduction Strategy, aims among other goals, to diversify and intensify crop, animal and aquatic production. Within this framework, the GOR puts emphasis on the promotion of the following commodities: rice in wetlands, maize, beans, wheat, Irish potatoes, oil crops such as soybeans, fruits and vegetables, tea and coffee (MINAGRI, 2004). Despite the findings of the agricultural household survey of 1990 (Kangasniemi, 1998), which showed that banana was the main cash crop for rural Rwandans, and was used to buy staple crops in the market, banana production is no longer promoted by current agricultural policies. Current government policies promote cereal production at the expense of roots, tuber crops, and bananas. The design of appropriate intervention requires information on the current agricultural policy.

Moreover, the coffee sector has gone through domestic deregulation since the mid-1990s. For instance, the liberalization of coffee policies allowed farmers to choose to grow coffee or not. In addition, with the liberalization of coffee marketing, coffee cooperatives and private investors responded positively to the policy changes and the associated incentives by building new processing plants. Starting with only two washing stations operating in 2001, the number of coffee processing plants has jumped to more than a hundred washing stations in 2007 (SPREAD, 2007). The effects of the policy changes on growers' income have not yet been assessed.
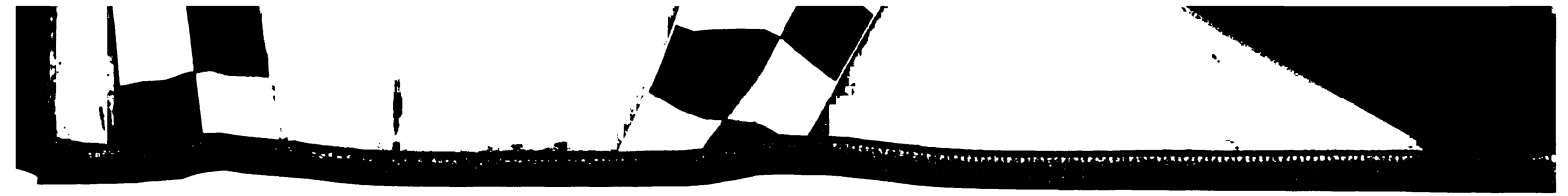
Studies of the impact of market reforms on smallholder farmers show that households respond by taking advantage of opportunities created by the reforms. They

also react to the reforms by protecting themselves from their adverse effects. While market reforms can facilitate poverty reduction, the findings of Winters et al. (2004) were, however, not conclusive on the exact impact of the reforms either in theory or empirically. The effects of market reforms on farmers depend on circumstances that underline the economic conditions of the target population. They also depend on measures taken to implement the reforms.

This dissertation has explored three major research questions related to assessing the effects of policy reforms on household income. These questions are analyzed in three separate essays but the last two essays are closely related. The first essay identifies the determinants of rural household income among coffee growers and non-coffee growers. The second essay analyzes whether farmers have benefited from coffee reforms. Finally, the third essay explores whether the impacts of coffee reforms depend on where farmers sell their coffee, either private or cooperative channels.

Findings of this study showed that growing a large number of staple crops was positively associated with household expenditures for both coffee growers and non-coffee farmers. Given the major role played by staple crops in improving household expenditures, household food security rather than commercialization of agriculture, can contribute to reduce rural poverty in Rwanda. These findings call for policies to support research and dissemination of technologies that increase the yield of staple crops and economic return of the land-constrained capital.

Moreover, off-farm income opportunities and formal wage were associated with increasing household income. Similarly, sales of livestock products, such as milk or eggs, as well as the production and sale of fruit contribute significantly to improving household
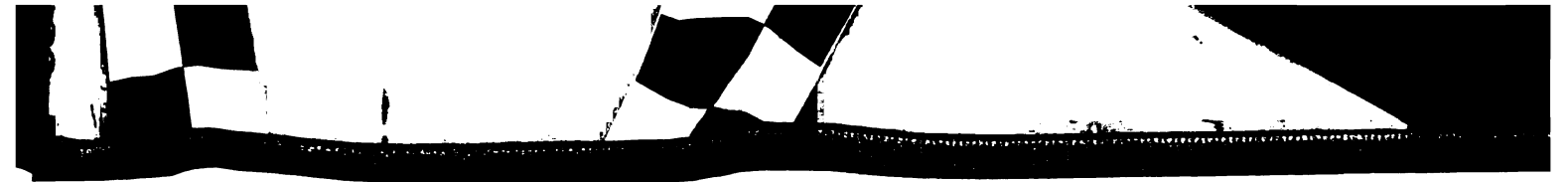
income. Policies to increase the proportion of farmers engaged in off-farm activities, animal and fruit production will therefore be important in improving the well-being of farmers.

Regarding the effects of coffee sector reforms on farmer income, although the estimates of the policy variable for all dependent variables were not significant, the pattern of the effects of the coffee reforms is in the right direction. This dissertation finds that farmers benefited from coffee reforms by increasing their expenditures over time. Moreover, farmers who sold coffee to the cherry market were found to gain more than their counterparts who sold to the parchment market. These results suggest that coffee policy reforms introduced by the GOR have improved food security and the overall consumption expenditures of coffee growers. Another coffee study that incorporates the time dimension of when farmers started switching from the parchment market to the cherry market can capture the effects of coffee policy reforms in Rwanda.

Policies that encourage the production of high quality coffee and investment in coffee processing appeared to improve the well-being of coffee farmers. The GOR has removed the export tax to owners of processing facilities, thus giving tax incentives to coffee investors to expand coffee processing in areas that are still selling parchment coffee. Credit incentives to enhance investment in building new processing plants could be fostered. These policies can increase the number of farmers selling coffee cherries and therefore improve their economic conditions.

Finally, in the search for the organizational form of the coffee supply chain that is most likely to benefit farmers, this dissertation compares the effects of farmer cooperatives and private processors on household expenditures. Previous studies on

organizational forms have focused on efficiency differences between cooperatives and IOF but not much about how these supply chains affect farmers. The data analysis finds that the choice of the coffee supply chain by coffee growers on annual food and total household expenditures per adult equivalent is not statistically significant.

The finding on the role of the type of coffee supply chain on household income is important for development policy. Despite heavy investment in helping farmer cooperatives to access the specialty coffee market, private processors are able to compete and sometimes offer better services and benefits to coffee growers compared with cooperatives. Working with cooperatives to introduce the new technology of producing high quality coffee may be cost effective during the early stages of the technology transfer. However, as the coffee industry has been stabilized and more private investment has been undertaken, there is less need to financially support cooperatives. More support should be directed towards strengthening the regulatory coffee agency and enabling it to put in place coffee policies that provide economic incentives for coffee stakeholders to operate.

Finally, given the financial and managerial strengths of private entrepreneurs and problems faced by Rwandan cooperatives, a cooperative-private partnership can improve the performance of the coffee cherry supply chain. Further research is necessary to better understand how private processors and farmers can form a partnership and increase the return on their investment. Future analysis of case studies that looks at how private processors work closely with farmer cooperatives can shed some light on how to improve the performance of the coffee industry.

Appendix 4.1. Food Consumption Budget Shares

	Item	Share of food purchases	Share of own-consumption	Total share
1	Dried beans	7.89%	7.62%	15.51%
2	Sweet potatoes	3.69%	10.08%	13.77%
3	Potatoes	4.59%	4.41%	8.99%
4	Cooking banana	1.35%	4.93%	6.28%
5	Cassava root	0.90%	2.02%	2.92%
6	Local beer banana	1.44%	0.83%	2.27%
7	Salt	1.90%		1.90%
8	Palm oil	1.76%	0.00%	1.76%
9	Sorghum juice	1.20%	0.55%	1.75%
10	Corn cob	0.24%	1.15%	1.39%
11	Locally grown rice	1.38%		1.38%
12	Tomatoes	1.04%	0.26%	1.30%
13	Banana beer	0.22%	1.07%	1.29%
14	Kernel corn	0.78%	0.48%	1.26%
15	Sorghum grain	1.11%	0.14%	1.26%
16	Local beer sorghum	0.84%	0.22%	1.06%
17	Peanut oil	0.85%	0.00%	0.85%
18	Local banana juice	0.15%	0.58%	0.73%
	Total	31.33%	34.34%	65.67%

Source: Calculated by the author from the 2001 household expenditure survey

Appendix 4.2. Non-Food Consumption Budget Shares

	Item	Budget share
1	Transfers	8.50%
2	Finished garments	6.97%
3	Education expenses	6.46%
4	Laundry soap	6.00%
5	Cloth	4.67%
6	Energy expenses (Gaz- Kerosine)	3.88%
7	Hair cut expenses	3.43%
8	Shoes	3.32%
9	Transport expenses	2.43%
10	Health expenses	2.43%
	Total	48.09%

Source: Calculated by the author from the 2001 household expenditure survey

Appendix 4.3. Scaling parameters for the computation of adult equivalents

Age	Sex	Parameter
>=70	both	0.7
>=60 & <=69	both	0.8
>=50 & <=59	both	0.9
>=40 & <=49	both	0.95
>=20 & <=39	both	1
>=16 & <=19	female	1.05
>=16 & <=19	male	1.02
>=13 & <=15	female	1.13
>=13 & <=15	male	0.97
>=10 & <=12	female	1.08
>=10 & <=12	male	0.97
>=7 & <=9	both	0.91
>=4 & <=6	both	0.76
>=1 & <=3	both	0.56
<1	both	0.41

Source: MINICOFIN, 2002

Appendix 5.1. Winners of the 2007 Rwanda Golden Cup*

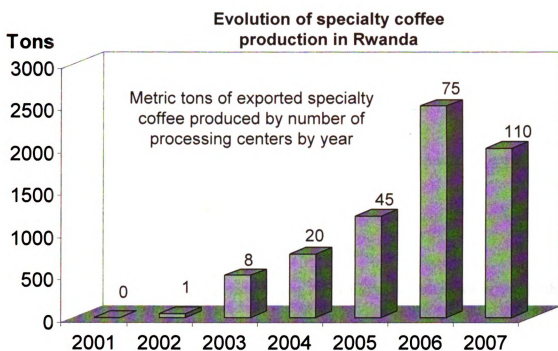| Rank	Province	District/location	Name of processing factory	Type of organization	Final Scores
1	Northern	Gakenke	SDL Muyongwe	Cooperative	93.41
2	Southern	Nyamagabe	MIG-Ngoma	Private	91.72
3	Southern	Nyamagabe	KOAKAKA	Cooperative	90.75
4	Western	Nyamasheke	CWS KANZU	Private	90.45
5	Southern	Kamonyi	UCAR	Cooperative	90.00
6	Southern	Nyamagabe	MIG-Ngoma	Private	88.63
7	Western	Rusizi	NILE CONGO MOUNTAIN COFFEE	Private	87.00
8	Western	Nyamasheke	CWS CYIYA	Private	86.81
9	Southern	Huye	MIG-Buremera	Private	86.69
10	Western	Nyamasheke	CWS NGOMA	Private	86.66
11	Southern	Kamonyi	UCAR	Cooperative	86.63
12	Eastern	Gatsibo	COCAF	Cooperative	86.28
13	Western	Nyamasheke	CWS RWABISINDU	Private	85.78
14	Southern	Huye	MIG-Murera	Private	85.50
15	Southern	Kamonyi	KAYCO	Private	85.44
16	Western	Rutsiro	HORIZON CWS	Private	85.31
17	Western	Rutsiro	HORIZON CWS	Private	85.20
18	Northern	Gakenke	SOPROCAF	Private	85.19
19	Southern	Huye	CWS SOVU	Cooperative	85.16
20	Western	Rutsiro	CWS KINUNU	Private	84.09

*All coffee are type Rwanda Fully Washed Arabica, Grade A1

Appendix 5.2.Winners of the 2008 Coffee Cup of Excellence Competition*

Rank	Province	District/ location	Name of processing factory	Type of organization	Final Scores
1	Southern	Huye	MIG-Buremera	Cooperative	92.07
2	Northern	Gakenke	FAKCO-Rulindo	Private	90.84
3	Southern	Huye	MIG-Buremera	Private	89.41
4	Northern	Gakenke	SDL MINAZI	Cooperative	89.07
5	Northern	Gakenke	SDL Muyongwe	Cooperative	89
6	Southern	Huye	CWS SOVU	Cooperative	88.95
7	Southern	Nyamagabe	BUFCOFFEE	Private	88.36
8	Western	Rubavu	COOPAC	Cooperative	88.07
9	Southern	Huye	MIG-Buremera	Private	87.98
10	Western	Rubavu	HORIZON CWS	Private	87.09
11	Southern	Nyamagabe	BUFCOFFEE	Private	86.98
12	Western	Rubavu	COOPAC	Cooperative	86.26
13	Western	Rubavu	HORIZON CWS	Private	86.19
14	Northern	Gakenke	SDL Musasa	Cooperative	85.90
15	Western	Nyamasheke	Nyabumera Cooperative	Cooperative	85.90
16	Southern	Huye	MIG-Murera	Private	85.86
17	Western	Rutsiro	HORIZON CWS	Private	85.76
18	Southern	Nyamagabe	BUFCOFFEE	Private	85.55
19	Southern	Huye	CWS SOVU	Cooperative	85.38
20	Southern	Huye	CWS KABUYE	Cooperative	85.17
21	Western	Rusizi	SDMLJ	Cooperative	84.83
22	Southern	Nyamagabe	MIG Kibumbwe	Private	84.73
23	Southern	Nyamagabe	BUFCOFFEE	Private	84.5
24	Western	Rubavu	COOPAC	Cooperative	84.48

*All coffee are type Rwanda Fully Washed Arabica, Grade A1

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Appendix 5.3.Trends in the production of specialty coffee in Rwanda

Evolution of specialty coffee production in Rwanda

Tons

Metric tons of exported specialty coffee produced by number of processing centers by year

Year	Value
2001	0
2002	1
2003	8
2004	20
2005	45
2006	75
2007	110

Source: SPREAD, 2007

REFERENCES

Bacon, C. (2005). "Confronting the coffee crisis: can fair trade, organic, and specialty coffees reduce small-scale farmer vulnerability in northern Nicaragua?" World Development 33(3): 497-511.

Baffes, B., B. Lewin, and P. Varangis. (2005). "Global Agricultural Trade and Developing Countries." THE WORLD BANK.

Badiane, O. and K. Mylene. (1999). "Market liberalization and the poor." Quarterly Journal of International Agriculture 38(341-58).

Bahizi (2007). "Personal conversation with the author."

Bihogo, E. (2006). "Personal conversation with the author."

Bijman, J. and R. Ruben. (2005). "Repositioning Agricultural Cooperatives in the North and the South: Where does the Twain meet?" Paper presented in second Agri-ProFocus Expert Meeting.

Bingen, J. and L. Munyankusi (2002). "Farmer Associations, Decentralization and Development in Rwanda: challenges ahead." Agricultural Policy Synthesis. Rwanda Food Security Research Project/ MINAGRI.

Boudreaux, K. (2007). "State Power, Entrepreneurship and Coffee: The Rwandan Experience." Mercatus Policy Series, Policy Comment No. 15.

Bussolo, M., O. Godart, J. Lay and R. Thiele (2006). "The impact of coffee price changes on rural households in Uganda." Agricultural Economics 37: 293-303.

Chambers, R. and W. Foster. (1983). "Participation in the farmer-owned reserve program: a discrete choice model." American Journal of Agricultural Economics 65(1): 120-124

Cleves, R. (1995). "Tecnolog'ia de Beneficiado (Coffee Processing Technology)." Tecnicaf'e International S.A., Costa Rica.

Daviron, B. (2005). "Global Markets, Commodity Trade and the Elusive Promise of Development." Zed Books in association with CTA.

Deininger, K. `and J. Okidi. (2003). "Growth and poverty reduction in Uganda, 1992-2000: panel data evidence." Development Policy Review 21(3): 481-509.

DeLucco, P. (2006). "Specialty Coffee: Improved market Linkages & Increased Profits: Raising the Bar: Producing Quality Coffee in Rwanda." World Report, ACDI/VOCA. Washington DC.

Diop, N., P. Brenton, and Y. Asarkaya (2005). "Trade Costs, Export Development and Poverty in Rwanda." World Bank Policy Research Working Paper 3784.

Donovan, C., E. Mpyisi and S. Loveridge. (2002). "Forces Driving Change in Rwanda Smallholder Agriculture 1990-2001." Food Security Research Project. Research Report to USAID.

Economic Intelligence Unit. (2007). "Press Release." The Economist.

Ferrantino, M., G. Ferrier and C. Linvill (1995). "Organizational form and efficiency: Evidence from Indian Sugar Manufacturing." Journal of Comparative Economics 21: 29-53.

Giovannucci, D. and F. Koekoek. (2003). "The State of Sustainable Coffee: A study of twelve major markets."

Gittinger (1982). "Economic Analysis of Agricultural Projects." World Bank.

Goff, S. (2006). "The management of coffee cooperatives in Rwanda: Three case studies." Unpublished master's thesis, Texas A&M University, College Station.

Grosse, S. (1994). "More people, more trouble; Population growth and agricultural in Rwanda. Environmental and Natural resources Policy and Training (EPAT) project "Report to USAID.

Jayne, T. and J. Govereh (1999). "Effects of cash crop production on Food crop productivity in Zimbabwe: Synergies or trade-offs?" Food Security Research Project. Policy Synthesis No.40

Kangasniemi, J. (1998). "People and Banana on Steep Slopes: Agricultural Intensification and Food Security Under demographic Pressure and Environmental Degradation in Rwanda." Unpublished Dissertation. Michigan State University.

Katz, J. (1997). "Managerial behavior and strategy choices in agribusiness cooperatives." Agribusiness 13 (5): 483-495.

Koenker, R. a. K. H. (2001). "Quantile Regression." Journal of Economic Perspectives 15(4): 143–156.

Loveridge, S., J. Nyarwaya and E. Shingiro (2003). "Decaffeinated? Situation, Trends, and Prospects for Coffee Production in Rwanda. Analysis of a rural household Survey." Research report.
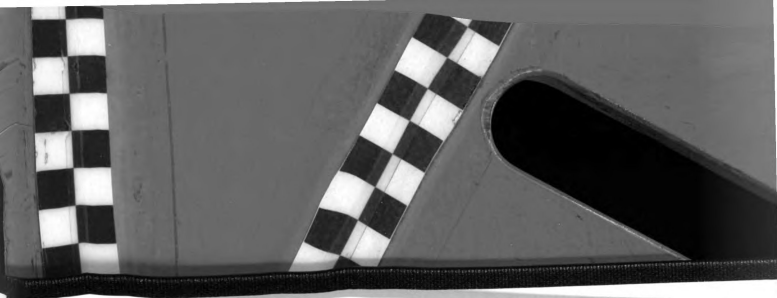
McKay, A. and S. Loveridge. (2005). "Income and Nutritional outcomes in Rwanda's Rural Areas, 1990 and 2000." <u>Food Security Research Project/Minagri. Policy Synthesis No.74</u>.

MINAGRI (1992). "Enquête Nationale Agricole 1990: Production, superficie, rendement, élevage et leur évolution 1984-1990." <u>Division des Statistiques Agricoles. Publication DSA 26. Kigali, Rwanda</u>

MINAGRI (2004). "Strategic Plan for Agricultural Transformation in Rwanda."

MINICOFIN (2002). "A profile of poverty in Rwanda. A report based on the results of the household living standards survey." <u>NISR</u>.

MINICOFIN (2004). "Poverty Reduction Strategy" <u>Annual Progress Report. Kigali. Rwanda. </u>.

Mosheim, R. (2002). "Organizational type in the Costa Rican Coffee Processing Sector." <u>Journal of Comparative Economics</u> 30: 296-316.

Mosheim, R. (2008). "Efficiency and Survival: The impact of the international coffee agreement's demise of Costa Rica's cooperative coffee processing, 1988-2005." <u>Annals of Public and Cooperative economics</u> 79(1).

Nkonya, E., J. Pender, D. Sserunkuuma, P. Jagger, C. Kaizzi and H. Ssali (2004). "Strategies for Sustainable Land Management and Poverty Reduction in Uganda." <u>International Food Policy Research Institute. </u>.

Nowak, P. (1987). "The adoption of agricultural conservation technologies: economic and diffusion explanations." <u>Rural Sociologies</u> 52: 208-220.

Nyoro, J. and I. Nguki. (2005). "A qualitative analysis of success and failure factors of agricultural cooperatives in Central Kenya." <u>Tegemeo Institute of Agricultural Policy and Development, Egerton University</u>.

Olivieri, S. G. (2001). " Evaluation, Résultats et Stratégies de Marketing pour Développer le Potentiel du Rwanda à Entrer dans l' American Specialty Coffee Market." <u>ADAR, PEARL /USAID</u>

OCIR café (1999). "National Coffee Census and Assessment of the Present State of the Coffee Plantations in Rwanda" <u>Final Report by Agro Consulting Business. Ministry of Agriculture and Livestock</u>

OCIR café (2002). "The current situation of the coffee subsector." <u>MINAGRI</u>.

Oustapassidis, K., A. Vlachvei and K. Karantininis (1998). "Growth of Investor Owned and Cooperatives Firms in Greek Dairy Industry " Annals of Public and Cooperative economics 69(3): 399–417.

Pender, J., B. Gebremedhin, S. Benin, and S. Ehui (2001). "Strategies for sustainable development in the Ethiopian highlands." American Journal of Agricultural Economics 83 (5): 1231–1240.

Pender, J., F. Place and S. Ehui (1999). "Strategies for sustainable agricultural development in the east African Highlands." Strategies for poverty alleviation and sustainable resource management in the fragile lands of sub-Saharan Africa, eds. A. Knox McCullough, S. Babu, and P. Hazell. Feldafing, Germany: Food and Agriculture Development Centre.

Pender, J., F. Place and S. Ehui (2006). "Strategies for Sustainable Land Management in the East African Highlands." International Food Policy Research Institute.

Peterson, C., A.Wysocki, and S. Harsh (2001). "Strategic choice along the vertical coordination continuum." International Food and Agribusiness Management Review 4: 149-166.

Ravallion, M. (2005). "Evaluating Anti-Poverty Programs." Development research group, World Bank.

Royer, J. S. (1995). "Potential for cooperative involvement in vertical coordination and value added activities." Agribusiness 11(5): 473-481.

Rwandacafe (2006). "http://www.rwandacafe.com."

SCAA (1999). "Coffee Market Summary." Long Beach, Ca.

Schluter, J. E., and A. Finney. (2001). "Rehabilitation of Coffee Sector, Rwanda. Development of Washed Processing Within a Framework of Private Investment." Common Fund for Commodities/International Coffee Organization. Mimeo.

Spear, R. (2000). "The cooperative advantage." Ann.Pub.Coop. Econ 71(4): 507-523.

SPREAD (2007). "Annual Report."

Staatz, J. (1984). "Structural characteristics of farmer cooperatives and their behavioral consequences." Working Paper. Michigan State University.

Tardif-Douglin, D., J. Ngirumwami, J. Shaffer, A. Murekezi and T. Kampayana (1996). "Finding the Balance Between Agricultural and Trade Policy: Rwanda Coffee Policy in Flux." Department of Agricultural Economics Michigan State University International Development Working Papers: 59.

USAID/Rwanda (2005). "Annual Report."

Verwimp, P. (2003). "The Political Economy of Coffee, Dictatorship, and Genocide." European Journal of Political Economy 19(2): 161-181.

Walker, D. (2001). "Farm-to-Market partnerships Program. Report of Coffee Marketing. Business Plan Development for UPROCA Cooperative, Gisenyi-Rwanda " ACDI/VOCA.

Wessen, P. (1998). "Institutional economics of Arabica coffee marketing in Cameroon." PhD Dissertation, Michigan State University.

Winters, A. L., N. McCulloch and A. McKay (2004). "Trade liberalization and poverty: the evidence so far." Journal of Economic Literature XLII (1): 72-115.

Wollni, M. and M. Zeller. (2007). "Do farmers benefit from participating in specialty markets and cooperatives? The case of coffee marketing in Costa Rica." Agricultural Economics 37: 243-248.

Wooldridge, J. (2002). "Econometric Analysis of Cross Section and Panel Data." Cambridge, MA: MIT Press.

Word Bank (1997). "The Rwandese Republic. Emergency Reintegration and Recovery. Report No.T-7149-RW."

You, L. and S. Bolwig. (2003). "Alternatives growth scenarios for Ugandan coffee to 2020." International Food Policy Research Institute.

Zbinden, S., and D. Lee (2005). "Paying for environmental services: an analysis of participation in Costa Rica's PSA Program." World Development 33(2): 255-272.

Zhang, A., Y. Zhang and R. Zhao (2001). "Impact of Ownership and Competition on the Productivity of Chinese Enterprises." Journal of Comparative Economics 2(327–346).

Zesch, S. (1987). "Food crops versus cash crops : a spurious controversy ?" Technoserve