Efficiency and performance of rice marketing chain in Togo

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ABSTRACT

Agricultural markets and their development are viewed as a major tool in alleviating rural poverty in developing countries, especially in Sub-Saharan Africa. In this context, the current study empirically examines the efficiency and performance of rice marketing along with its actors in Togo, a small country located in West Africa. The study analyzes various aspects of Togolese rice market such as: first, the major factors that determine rice marketed surplus among rice farming households in Togo; second, the margins obtained by different stakeholders in the rice value chain; and third, various constraints faced by both rice farmers and traders. The analysis was done using cross sectional data collected from rice producers and traders in Togo during the consumer preferences survey initiated by AfricaRice Center in 2010. The econometric model of determinant of marketed surplus was estimated using both Tobit and Heckman two stage selection model. Overall estimates indicate that production of paddy rice by the household enhances rice farmer's market participation in Togo, whereas transactions costs significantly hinder market participation. These results lend support to policy interventions that are directed toward improved rice production and post harvest management practices at the farm level along with provision of better market infrastructure facilities, in order to reduce transaction costs in the rice markets in Togo. Our results further indicate that the existing market prices for rice affects only farmers' likelihood of participating in the market, and does not affect the quantity of rice supplied to the market. This unresponsiveness of Togolese rice farmers to price signals confirms the existence of considerable imperfections in the rice market in Togo. These results further suggest that price policies will not be effective if the transactions costs and related issues that hinder the Togolese rice market performance are not properly addressed. This is also supported by our detailed analysis on knowing the market power across the markets (5 regions) located in Togo. The concentration ratio obtained in these markets indicates the presence of oligopoly power in the rice marketing chain in Togo. This adds to the existing transaction costs and drives up market margins such that producer receive a smaller share of the dollar paid by the final consumer of rice at the retail level in Togo. The Government of Togo and development agencies should supplement the improvements in rice production by addressing those market imperfections as a prerequisite for the development of the rice in Togo, in order to reduce imports and improve the livelihood of producers.

RESUME

La commercialisation des produits agricoles est l'un des principaux outils de réduction de la pauvreté en milieu rural dans les pays en voies de développement, surtout en Afrique Sub-saharienne. Des lors, la présente étude s'intéresse à l'analyse empirique de l'efficacité et de la performance de la chaine de commercialisation du riz au Togo, un petit pays situé en Afrique de l'Ouest. Les objectifs spécifiques poursuivis incluent l'analyse des déterminants de la participation des producteurs au marché de riz, les marges de commercialisation du riz, ainsi que les principales contraintes auxquelles font face les producteurs et commerçants de riz du Togo. Les analyses sont basées sur des données transversales collectées chez les producteurs et commerçants de riz du Togo, lors d'une enquête sur les préférences des consommateurs de riz, initiée en 2010 par le Centre du Riz pour l'Afrique. Le modèle Tobit et le modèle de sélection de Heckman ont tous deux été utilisés pour estimer les déterminants de la participation au marché des producteurs de riz. Globalement, les résultats indiquent que la production de riz paddy par le ménage affecte positivement la participation des producteurs au marché du riz du Togo, tandis que les couts de transaction y exercent plutôt une influence négative. Ces résultats encouragent donc les interventions politiques qui visent à améliorer la productivité et les stratégies post-récoltes du riz, ainsi que les interventions visant à réduire les couts de transaction dans la chaine de commercialisation du riz au Togo. De plus, les résultats indiquent que le prix du riz n'affecte que la probabilité qu'un producteur participe au marché, mais n'affecte pas la quantité de riz vendu par le producteur. Ceci indique que les producteurs de riz du Togo sont peu réceptifs aux signaux de prix, ce qui confirme l'existence d'importantes imperfections qui méritent d'être corrigées dans le marché du riz au Togo. Le calcul des indices de concentration dans chacune des 5 régions du Togo a révélé la présence d'une oligopolie dans le marché du riz au Togo. Ceci s'ajoute aux couts de transaction existantes et augmente les marges de commercialisation de sorte à ce que les producteurs ne reçoivent qu'une faible part de chaque dollar payé par le consommateur final de riz. Dans le but de réduire les importations de riz au Togo et améliorer les conditions de vies des pauvres paysans, le gouvernement du Togo et les agences de développement devraient corriger ces imperfections dans le marché, en plus d'améliorer les techniques de production du riz au Togo.

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DEDICATION

To my late beloved father Innocent Adjognon. I hope from wherever you are, you can watch this and just be proud $\ensuremath{\mathfrak{O}}$

ACRONYMS

DSID	Direction des Statistiques agricoles, de l'Informatique et de la Documentation
FAO	Food and Agriculture Organization
FCFA	CFA Franc, currency used in formerly French ruled Africa
FTC	Fixed Transaction Costs
IMR	Inverse Mill Ratio
ITRA	Togolese Institute for Agricultural Research
MAEP	Ministry of Agriculture Livestock and Fisheries
MERF	Ministry of Environment and Natural Resources
OLS	Ordinary Least Square
OSAT	Observatory for Food Security of Togo
PTC	Proportional Transaction Costs
SSA	Sub-Saharan Africa
UNDP	United Nation Development Program
WARDA	West African Rice Development Association

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CHAPTER I: INTRODUCTION

1.1. BACKGROUND AND PROBLEM STATEMENT

For most low income countries, especially those in Sub-Saharan Africa (SSA), the agriculture sector is a major, single significant economic activity employing nearly 65% of the labor force, and generating nearly 29% of the national gross domestic product (GDP) (World Bank, 2008). Not only is agriculture an important economic activity contributing to overall development and growth, but it also is a source of livelihoods for millions, and a provider of environmental services, making the sector a unique tool for development. The World Bank estimates that growth in the agriculture sector has a much bigger impact on poverty reduction than growth in non-agricultural sectors. For example in China and Latin America, aggregate growth originating in agriculture is estimated to have been respectively 3.5 and 2.7 times more effective in increasing expenditure than growth outside agriculture (World Bank, 2008). Yet in spite of the evidence on the important role played by the agricultural sector in the economy of these Least Developed Countries (LDCs), investment in the sector has remained low. According to the World Development Report 2008, public spending in agriculture has been shown to be lowest in agriculture-based countries where the share of agriculture in GDP is highest (World Bank, 2008). According to the New Partnership for Africa's Development (NEPAD), less than one percent of the budgets of many African governments are reported to be allocated to the agricultural sector (NEPAD, 2003). International organizations like the World Bank, who are the major donors to Africa also have significantly reduced their allocation to agriculture in these countries from 39 per cent in 1978 to 7 per cent in 2000 (NEPAD, 2003).

The persistent underinvestment in agriculture is one of the key factors that has resulted in poor growth in agriculture with impacts on other sectors of the economy exasperating poverty and wide spread food insecurity in SSA countries. The number of chronically undernourished people has been rising every year and there has been a progressive growth in food imports (NEPAD, 2003). According to NEPAD (2003), agricultural imports account for about 15 percent of total African imports, and imports of cereals by SSA countries are estimated at some 17 million tons in 2000, including 2.8 million tons of food aid. Food imports have come at a considerable cost and pressures on limited foreign exchange reserves. The most recent available data from

the World Bank and FAO website (2012) indicate that the value of total agricultural import in SSA has been rising, from 10.93 billion US\$ in 2001 to 32.46 billion US\$ in 2008, corresponding to more than 196% increase in 7 years. Yet much of the solution to poor nutrition and food shortage in SSA lies with expanding agricultural production in SSA itself (NEPAD, 2003). Greater agricultural production will provide opportunities for small farmers, in the sense that such large shortfalls provide a potential market to expand their output and improve their livelihoods, in turn enabling countries to reduce their import dependence. It is, of course, not enough that the focus be only on production as other institutions and services will be required to take advantage of the higher surplus generated. In this regard agricultural markets and their proper functioning play a crucial role in the growth of agricultural sector as a whole. Market imperfections can mitigate considerably the positive effects of agricultural growth on poverty alleviation (Gaiha, 1995). Indeed, imperfections in the market chain raise transaction costs and thus reduce consumer and producer surplus by increasing price paid by consumers and reducing price received by producers. Also, increasing agricultural production will not contribute much to agricultural development and to economic growth, unless it translates into increases in marketed surplus of agricultural production (Upender, 1990; Chakraborty, 2010). Marketing includes activities such as processing, distribution, transport, and retailing operations of commodities. Therefore, behavior of agents involved in such market related activities has an important effect on the welfare of both consumers and farmers (Wohlgenant, 2001; Jacoby and Minten, 2009). To better understand market imperfections along a typical agricultural value chain this study examines the production, marketing and distribution of rice in Togo.

Rice consumption in Togo ranks third after maize and sorghum and it amounts to 3% of the total GDP (MAEP-TOGO, 2010). As in most SSA countries, local rice production does not cover the needs of the country and consequently, despite the country's own potential to produce rice (more than 185,000 ha of lowland), the deficits in supply are still being made up by imports. Figure 1 presents the emerging trends in rice area, production and productivity in Togo from 2005 to 2008. The figure indicates that both yields and area planted of rice has been rising and as a result rice production has increased every year from 72,860 tons in 2005, to 85,540 tons in

2008—a growth of 17.40%. Despite these gains in output, rice consumption has risen faster with the shortfall being met by imports.





Source: DSID-MAEP-TOGO (2009)

Figure 2 presents the evolution of rice imports from 2000 to 2008. As shown in the figure 2, rice imports in Togo have risen from 36,270 tons in 2000 to 73,976 tons in 2008—a 100% increase. In 2008 the import bill for rice was estimated to be 4 billion FCFA which is equivalent to 7.48 million current USD.





Source: DSID-MAEP-TOGO (2009)

The above trends are not atypical for the rest of SSA where rice is a major food crop for domestic consumption in addition to being a cash crop towards income generation. According to WARDA (2006), rice is the most rapidly growing source for food in many parts of SSA with 10% of total cereal area occupied by rice acreage, contributing about 15% of total cereal production. Like Togo, even though many SSA countries have made significant progress towards increasing their rice production, consumption has been growing faster than production and the short fall in rice production has increased significantly, thus expanding the volume of imports (Olembo, M'mboyi and Oyugi, 2010). Furthermore, the recent fluctuations in global grain prices have made the situation worse and made the poor more vulnerable to the risks of food insecurity. Consequently, efforts to expand domestic rice production in Africa are urgently needed to contribute not only to the enhanced food security, but towards poverty alleviation and development of the region as a whole.

Towards this goal, Togo instituted the Togo National Rice Development Strategy (TOGO-NRDS) that aims at increasing the local rice production from 85,540 tons in 2008 up to 140,000 tons of milled rice by 2018. Specifically, the strategy includes increasing the areas available for cultivation from 36.492 to 66.500 ha; improving yields from 2.4 to 3.5T/ha; and increasing production for the periods 2008-2013 and

2013-2018 from 85.540 to 232.750 tons of paddy, i.e. 139.650 tons of milled rice (MAEP-TOGO, 2010). This will certainly require that the major problems in rice production be addressed more carefully. New improved rice varieties, fertilizers, irrigation techniques and machines need be made more accessible to farmers in order to increase their productivity and efficiency. Yet, the benefits from higher production need to be complemented by improvements in market efficiency. The numerous efforts to increase agricultural production are of no use without an efficient marketing system to direct that production and distribute the output to the points of its consumption. Without an efficient marketing system, producers cannot benefit from increasing demand due to the rising population, and consumers cannot benefit from improved technologies and increasing agricultural production. On the contrary, imperfections in the marketing system only contribute to worsening the effect of production shocks that are becoming more and more likely to happen in the context of climate change. It is therefore important that efforts be oriented not just toward increasing rice production but also towards increasing market efficiency and performance.

One measure of market efficiency are market margins defined as the percentage of the final selling price taken by the marketing chain (FAO, 2007). Market margins measure the cost of providing a set of marketing services, and the profit made by traders operating in the marketing chain. A competitive and efficient marketing chain would be characterized by low margins, such that the price that consumers pay is closer to what the producers receive. But market margins are usually relatively high in developing countries translating important inefficiencies in agricultural marketing chain. This is due to the layers of intermediaries in the value chain, as well as the inadequate transport and communication infrastructures that raise transaction costs (World Bank, 2008). For example marketing margins in Ghana's maize market were estimated to represent about 44% of the retail price while farmers receive about 56% in 2006. (World Bank, 2008) . Understanding the composition of those margins is essential for designing some policy actions that aims at reducing them and thus improving consumers and producers' welfare.

Consistently high and volatile prices are also a reflection of market inefficiencies. According to Barrett (2009), the sudden spikes in food prices observed in 2008 and 2010 originated from a combination of production shortfalls and market failures that quickly generated a gap between supply and demand. Figure 3 presents the evolution of rice prices in the different regions of Togo over the decade 1998-2009. The figure indicates that Togolese rice sector is also subject to considerable price fluctuations and in general rice prices have been rising in all regions of Togo and at the national level.





Source: Author's own computation from OSAT data

This increasing trend in rice prices suggests a widening gap between supply and demand of rice in Togo in spite of the continuous efforts made to increase agricultural production in the country. Such situation may indicate that rice farmers in Togo are still oriented toward subsistence agriculture and they supply a too small share of their produce to the market. It may also be due to the fact that the rice marketing chain in Togo is not performing well and considerable market imperfections may need to be addressed to stimulate the development of the rice in Togo.

Despite the important role that market systems play in transforming surpluses into higher incomes, our understanding of agriculture markets remains incomplete in many respects, especially for countries in West Africa, such as Togo. One issue, for example is what the determinants of farmers' participation in agricultural markets are. Without an increase in marketed surplus of agricultural production (the part of the production that actually enters the market), we cannot expect an increase in agricultural production to contribute much to agricultural development and to economic growth. Khadem (2008) pointed out that the way agriculture can boost economic development is by generating sufficient rate of marketed surplus, which plays a crucial part in improving rural capital on the one hand, and on the other help in eradicating rural poverty and regional imbalance. Therefore it is important to understand the factors that influence farmers' market participation behavior in order to take appropriate policy actions. Studies on farmers' market participation in SSA have focused primarily on eastern, central and southern parts of Africa such as Ethiopia (Holloway et al., 2004); Kenya (Alene et al., 2008; Omiti et al., 2009); banana markets in the central africa (Ouma et al., 2010); eastern and southern Africa (Barrett, 2008), amongst others. Also studies focusing on analyzing the actors that are involved in agricultural markets, the constraints they are facing, and how their behavior and interactions influence structure and performance of agricultural markets in West Africa are lacking critically. Even though all regions in SSA generally face the same kinds of market constraints, the ways market actors adjust to those constraints can vary considerably from one region to the other, leading to differences in market efficiency and performance across regions. Smale et al. (2009) found considerable differences, in terms of characteristics of the value chain, market infrastructure characteristics, vendors characteristics, and market participation, between seed markets in Kenya (Central Africa) and Mali (West Africa). This justifies then the implementation of localized studies about performance and efficiency of agricultural markets in the West African region. This is crucial for the designing of accurate policy plans that target the right problem in the value chain for agricultural development and poverty reduction in West Africa.

Hence, in this research, we attempt to answer several questions that critically analyses the role of various actors in the Togolese rice value chain and the constraints faced by these actors towards transactions in Togolese markets. In this regard, we tried to empirically analyse the following three objectives using a unique data set collected from farmers and traders of rice in Togo.

1.2. OBJECTIVES OF THE STUDY

This study aims at providing an empirical analysis of local rice marketing chain in Togo in order to draw some policy recommendations that improve the efficiency and performance of the local rice market. Specifically, the proposed research has been designed to achieve the following objectives:

- Identify the factors that affect the farmer's decision to participate in the market. Once the farmers decide to participate in the market, determine the factors that affect the quantity of rice traded in the markets of Togo;
- 2. Analyse the structure and performance of local rice marketing chain in Togo (Concentration ratio, marketing channels and market margins);
- Identify the major constraints faced by rice producers and traders in Togo.

The present research study is organized and presented in five chapters as follows, with this first chapter providing a general introduction along with motivation of the research and research objectives to be studied. The next chapter summarizes the review of past studies related to economic concepts used in studying the marketing of agricultural commodities among various stakeholders in the value chain and also different methodologies used for analyzing the farmer behavior related to market transactions in the literature. This helped further to formulate necessary hypotheses relevant to existing rice systems in Togo, methods to empirically test them using structured data collection and analytical methods, that are described in chapter 3. The results from the empirical testing of the data on farmers and marketing actors in the rice value chain are presented in chapter 4. The final and 5th chapter provides conclusions out of the current research study and necessary policy recommendations are derived further to improve the efficiency of rice marketing in Togo.

CHAPTER II: LITTERATURE REVIEW

This chapter is a review of key studies related to the marketing of agricultural commodities among various stakeholders in the value chain and also different methodologies used to analyze farmer behavior related to market transactions. We start by presenting the general characteristics of agricultural markets in developing countries highlighting the importance of well performing markets for the development of agriculture. Markets emerge from the combination of supply and demand. Supply of agricultural product to the market is only guaranteed when producers sell a share of their production. We define and distinguish the important concepts of marketed and marketable surplus in agriculture with a focus on why it is significant for agricultural development and poverty reduction in rural economies.

Since the first objective of this study is to analyze the main factors that determine rice farmers' participation to the market in Togo we also review of empirical findings about the determinants of marketed surplus for various commodities in the developing world. The available literature on farmers' market participation decision has largely used the Agricultural Household Model framework (Singh, Squire and Strauss, 1986; Lapar, Holloway and Ehui, 2003; Fafchamps and Hill, 2005; Alene *et al.*, 2008; Barrett, 2008), which we present briefly before applying it later in chapter 3 to model our case. We finish this chapter by presenting also the theory about the Structure-Conduct-Performance (SCP) paradigm since our second objective is to analyze the structure and performance of the rice marketing chain in Togo.

2.1. CHARACTERISTICS OF AGRICULTURAL MARKETS IN DEVELOPING COUNTRIES

It is widely felt that more attention needs to be given to the development of agricultural markets in developing countries, especially in Africa (Upender, 1990; Gaiha, 1995; Khadem, 2008; Jacoby and Minten, 2009; Chakraborty, 2010; ILRI, 2011). According to Barrett (2009), poverty reduction in Africa requires better and more accessible markets as new farm technologies and successful macroeconomic policy. Agricultural productivity is a necessary but not a sufficient condition for poverty reduction and improved living standards in most of SSA. The sudden spikes in food prices observed in 2008 and 2010 originated from a combination of production shortfalls and market failures that quickly generated a gap between supply and

demand. Without appropriate policy actions which successfully address both production and market shortcomings, the gap between food availability and food demand is expected to become larger (ILRI, 2011).

As indicated in chapter 1, much of the policy actions for agricultural development in Africa have focused on increasing agricultural productivity through improved agricultural inputs and technologies. But even though increased production is very likely to create significant opportunities for the African agriculture, it will not be enough to simply produce more food from the field without concurrent improvements in policies, infrastructure, and other market enhancing actions that can increase food availability and help stabilize and lower food prices.

Barrett (2009) discussed several reasons why more attention should be devoted to markets for African agricultural development. We summarize them in three main points here. First, markets are important for the transmission, over time and space, of policy signals sent by government interventions. Government interventions are usually directed toward changing constraints and incentives so that it becomes rational for people to behave the way that is desired by the government. For example exchange rate, fiscal, monetary, and trade policy are meant to encourage (or discourage) production, import, export, and innovation. And the channel through which these signals are meant to operate is the market. Therefore when the market doesn't function properly, the signals are distorted before they reach the targeted economic agents (firms, households, workers.) and thus may provide perverse incentives that lead to actions other than the desired ones.

Second, markets play an aggregative function that enhances efficiency and provide better opportunities to the poor, compared to the situation where there is an absence or incomplete market. Indeed, well-functioning markets boost the responsiveness of farmers and firms to new technologies and innovations by aggregating demand and supply across space and time in a manner that increases the price elasticity of demand and supply faced by economic agents. Jayne, Chapoto and Shiferaw (2009) p46 raises this specific issue as follows:

"how to expand and sustain the demand for the surplus produce in such a way that depressed producer prices [...due to increased market supply...] will not create disincentives for farmers to invest in new technology, or even worse withdraw from markets and gradually retreat back into the "safety" of semisubsistence farming".

According to Jayne, Chapoto and Shiferaw (2009), the ultimate answer to that question is the market that functions well enough to link effectively farmers to the wholesalers, processors, retailers and consumers. Also, markets promote specialization and exchange at larger scales, thus increasing efficiency gains in the global economies. By Ricardo's law of comparative advantage, people can specialize in the production of the good for which they are the most efficient, and then trade with other people for the goods they don't produce. Without well performing markets, people are very likely to deviate from that law and there are chances that efficiency losses arise. Finally, well-functioning markets play an important role on reducing price volatility from which emerges food crisis. Notice that in SSA countries, insurance markets are poorly developed and people are very vulnerable to agricultural input price spikes.

Third, according to the induced innovation model of agricultural development, changes or differences in the relative prices of factors of production influence considerably the direction of invention or innovation. Indeed, prices are supposed to reflect accurately the relative scarcity of factors of production, thus creating the need to develop innovations and technologies that save the scarce resources and consume the abundant ones. In presence of market failure, prices are not determined by aggregate supply and demand, and thus do not embed the relative scarcity of factors of production. Therefore the types of innovation induced by those inaccurate price signals are less likely to be beneficial for agricultural development.

Considering all these reasons, there is no doubt about the necessity of increased focus on market development for African agriculture. But before any action can be taken we need to know how African agriculture markets are performing currently, and what the challenges for pro-poor market development are. The analysis of the structure and performance of rice market in our second objective is a contribution to the understanding of how rice market is performing in Togo.

There are many factors that hamper the development of market for agricultural produce in developing countries especially in SSA, namely: poor infrastructure, inadequate support services, and weak institutions, pushing up transaction costs and

price volatility (World Bank, 2008). These factors are sources of wide marketing costs and poor market integration, which drives up marketing margins, therefore reducing both producers and traders returns, or increasing the cost of food to the consumers. Obviously, livelihoods, welfare, and food security are affected especially for poor households (World Bank, 2008).

In general, agricultural marketing channels are long and very complex in developing countries. Commodities are transacted multiple times among a variety of agents through various channels, from the farm gate to the table of the final consumer. Transaction costs are incurred at each stage of the marketing channel so that the longer the channel, the higher the total marketing costs, leading to wide marketing margins. For example, due to the layers of intermediaries that characterize Ghana's maize market, marketing margins were estimated to represent about 44% of the retail price while farmers receive about 56% (World Bank, 2008). According to Barrett (2009) who documented various reasons why marketing costs are high in African agriculture, access to and costs of both capital and transport are among the major impediment to African agricultural marketing, and therefore they are the priority areas for attention where governments and donors and NGOs can make a difference. In particular, transportation costs take on a great importance in the total marketing costs in agricultural marketing in developing countries, because access to markets is limited due to inadequate transport infrastructure and services in rural areas. The World Bank estimates that in Africa, less than 50 percent of the rural population lives close to an all-season road; and transport costs account for 50-60 percent of total marketing costs in Benin, Madagascar, and Malawi (World Bank, 2008).

Even when farmers sell their products at farm gate they indirectly incur transport costs by selling at lower price their agricultural produce to collectors (Jacoby and Minten, 2009). Therefore improving road connections is critical for improving the link of farmers to the market. Jacoby and Minten (2009) estimated the benefit of a hypothetical road project that reduces transportation costs in a small region of Madagascar. They adopted both a willingness-to-pay method and a hedonic price method. The direct benefit estimates (WTP) indicates that a road improvement making the remotest hamlet as accessible as the least remote, which implies a reduction in transport costs of about 75USD/ton, would be worth around 99,000 ariary of annual income. And 35% of this benefit is due to the lower effective price of imported consumption. The hedonic approach yielded benefit estimates that are substantially higher. Either way, they found considerable welfare gain from reducing transport costs by improving transport infrastructure. Transportations costs also play an important role in the choice of farmers whether to bring their agricultural product to the market or to sell at the farm gate (Fafchamps and Hill, 2005).

Another reason for high marketing costs in African agriculture is the poorly developed market information system. As we will explain later, poor access to market information reduces fixed transactions of market participation and hinders farmers' participation to the market. Market information relates to timely and accurate prices, buyer contacts, distribution channels, buyer and producer trends, import regulations, competitor profiles, grade and standards specifications, postharvest handling advice, and storage and transport recommendations. The provision of market information keeps farmers and traders adjusted to the demands and changing preferences of consumers, guiding farming, marketing, and investing (World Bank, 2008). But the World Bank estimates that public market information disseminated too slowly, in the wrong form, or too infrequently to be of real use to market participants (World Bank, 2008).

The transaction costs factors described above are expected to affect the performance of the rice market in Togo as well. In our objectives 1 and 2 we will be evaluating their effects on market margins and farmers' market participation and marketed surplus. In the following section, we move to the review of literature on the determinant of marketed surplus in agriculture after we provide the definition of the concept of marketed surplus and how it differs from marketable surplus.

2.2. MARKETABLE VS. MARKETED SURPLUS: DEFINITION AND IMPORTANCE

To understand the determinants of market participation and efficiency it is useful to make a distinction between marketed and marketable surplus. Semi subsistence farmers in developing countries such as most farmers in Togo utilize their agricultural produce in essentially two ways—either for own consumption and/or selling it in the market. Own consumption not only means satisfying the consumption requirements of the farmer's household, but also paying wages and debt in-kind, feeding animals, and making a reserve of seeds. What is left—the residual—is sold in the market and is

referred to as marketable surplus. Upender (1990) defines marketable surplus as the theoretical surplus that remains after the producer has met the genuine requirements of his family consumption, payment of wages in kind, feed and seed.

Marketed surplus is a closely related but a different concept. As the direct surplus of farm output over the retentions defined above, the concept of "marketable surplus" which is a subjective and ex-ante concept can be differentiated from the concept of "marketed surplus" which is an objective and ex-post concept. Indeed, marketable surplus refers to the surplus planned to be marketed whereas marketed surplus refers to the surplus actually marketed during a period of time. Marketable surplus can be higher than marketed surplus, indicating some losses or the stocks held by farmers to defer sales may be in the expectation of higher prices (Upender, 1990). Since farmers actually get some cash from the marketed surplus, we will focus primarily on marketed surplus rather than marketable surplus in this study.

According to Barrett (2008) the importance of marketed surplus comes from the law of comparative advantage of Ricardo. Households need a set of diverse commodities and services. They can either undertake production of all such goods and services for own consumption, or they can specialize in production of those goods in which they are relatively skilled – i.e., holds comparative advantage – consuming some portion and trading the surplus for other goods and services they need but for which they hold no comparative advantage in production.

Upender (1990) also discussed some of the reasons why marketed surplus is important. According to him, the significance of marketed surplus of foodgrains for the economic development of an agrarian economy comes mainly from the fact that increased marketed surplus would lead to the expansion of the industrial sector. Indeed, increased marketed surplus translates into increased income to the farmers, which in turn leads to higher demand for manufactured goods. The higher demand for such goods will naturally drive up the production of manufactured goods, leading to the development of the industrial sector. In addition, increased farm income is likely to induce higher rural saving and investment, which is desirable for the economic development of an economy. Also, increased marketed surplus is important as source of raw material for many agro industries (Upender, 1990). Besides, marketed surplus, especially food crops, has also important implications for food security in the sense that it guarantees the availability of agricultural products for purchase by those who don't work in the agricultural sector (Upender, 1990). In developing countries such as Togo where increasing demand for foodgrains due to the fast growing population has been met through large imports that are really costly to the countries, marketed surplus takes on a particular importance in reducing imports for sovereignty and food security purposes, and increasing export in order to get larger foreign exchange earnings.

Moreover, marketed surplus is important not only in primary economies but also in transition economies. As the non agricultural sector develops, marketed surplus in the agricultural sector need to increase to ensure food supply to all those people who work in the non agricultural sector, in urban areas (Upender, 1990).

2.3. DETERMINANTS OF MARKETED SURPLUS IN AGRICULTURE

Marketed surplus as defined above is a very important aspect in a peasant economy. An increase in marketed surplus both from quantitative and qualitative point of view is certainly desired to boost the economic development of rural areas. Most of the farmers in developing countries such as Togo are semi subsistence farmers and a large proportion of their produce is devoted to satisfy their family consumption requirements. But the level of farmer's income depends largely on net return from agricultural produce, which in turn depends on the level of marketed surplus. Therefore, the increase in agricultural production alone will not get more returns to the farmers. This increase needs to be accompanied by an increase in the share of the produce that is brought to the market, which is the marketed surplus. Even if output is being considered a major determinant of the size of marketable surplus, the real nature of the response of marketed surplus to changes in output is important to understand, and remains an empirical question.

A large body of literature has been developed to examine the determinants of agricultural marketing surplus in many developing countries. From the various studies that have focused on analyzing marketed surplus, the major factors that play a direct role in determining the level of marketed surplus are prices, transaction costs and output.

2.3.1. Price response of marketed surplus

The price response of the marketed surplus of subsistence crops has been a topic of major concern to agricultural planners in developing countries for many years. Therefore the earlier models on agricultural households were mostly focused on the response of households' behavior to change in prices. Theoretically, it is almost impossible to predict unambiguously the sign of the elasticity of marketed surplus with respect to an exogenous price. Indeed, marketed surplus is output less consumption; and both in the separable and non separable cases of agricultural household models, the simple supply and demand elasticities do not have unambiguous signs either (De Janvry, Fafchamps and Sadoulet, 1991). The empirical evidences have shown mixed results about the response of marketed surplus to increase in commodity prices.

Strauss (1984) estimated the elasticity of marketed surplus, for a set of commodities, including rice with respect to price and non-price variables. He used a separable agricultural household model with cross sectional household level data collected in rural Sierra Leone during the 1974-1975 cropping year. The results of his estimation indicated that mean own price elasticity of rice marketed surplus was positive and equal to 0.71. This meant that a 1% increase in price of rice would result in 0.71% increase in rice marketed surplus.

Upender (1990) estimated the response of marketed surplus of paddy rice to price movements using secondary time series data collected from selected markets in the State of Andhra Pradesh in India. For some selected markets for which data were available, this study used simple linear regressions with average annual price of paddy as explanatory variable and average annual market arrivals as dependant variable and proxy for marketed surplus. For the markets where the regression coefficient for prices was significant, it was also positive indicatig a positive relationship between market arrivals and paddy prices. This confirms the results of Chinn (1976) who had analyzed previously the marketed surplus of paddy rice in Taiwan, and had found that price and elasticity of total marketed surplus of paddy rice is positive.

Ouma et al. (2010) analyzed lately the determinants of smallholder farmers' participation in banana markets in central Africa and found a positive relationship

between banana selling price and intensity of market participation, confirming that price is an incentive to sell.

However, Bardhan (1970) used cross-sectional data collected from villages in northern India to study price and output response of marketed surplus of foodgrains. He used a linear regression model where the dependant variable was the marketed surplus as a proportion of total production. The result of the study indicates a negative response of marketed proportion of production to changes in foodgrain price. Price elasticity of marketed surplus was estimated to be -0.6 which implies that a 1% increase in foodgrain price would induce a reduction of marketed surplus by 0.6%. This was explained by the fact that larger grain price induce a profit effect that leads to rise in income which drives up demand for grain highly enough to outweigh the negative substitution effect on consumption.

Goetz (1992) also found the counterintuitive result that a higher price for coarse grains reduces the probability that a household sells a share of its production to the coarse grains market in Senegal. This was explained by the fact that higher prices are perceived by some households as a signal of impending food scarcity, motivating them to stock food.

2.3.2. Output response of marketed surplus

As part of his study on marketed surplus in India, Bardhan (1970) also examined the effect of grain production on marketed surplus. The results indicate that output has a significantly positive effect on marketed surplus. The output elasticity of the marketed surplus was found to be 0.8. This means that a 1% increase in size of output would increase marketed surplus by 0.8%.

Upender (1990) also estimated the response of marketed surplus of paddy rice to output of various size-groups through simple linear regressions, using cross sectional farm data. For all size groups, the regression coefficient for paddy was positive and significant indicating a positive relationship between marketed surplus and output of paddy. Again, this results confirm the findings of Chinn (1976) who had analyzed the marketed surplus of paddy rice in Taiwan. Upender (1990) found that elasticity of marketed surplus with respect to output exceeds unity for most size groups and the author concluded that the level of production is a basic and important factor in

determining the size of marketed surplus, and any increase in output is likely to be followed by a more than proportionate increase in marketed surplus of paddy in the study area. Therefore, any factor, such as availability of inputs, credit, or farm size that can directly influence agricultural productivity or agricultural production can be considered an indirect determinant of marketed surplus.

2.3.3. Transaction costs and marketed surplus

The structure of the market in which the household operates has important implication for the shaping the responses to exogenous policy and other shocks. Transaction costs include the costs of searching for a trading partner and making and enforcing a contract (Ouma *et al.*, 2010), and they are source of market failure by creating some constraints that don't allow the market to behave competitively. A market fails when the cost of a transaction through the market exchange generates disutility greater than the utility gain that it produces, therefore preventing the transaction to occur (Key, Sadoulet and Janvry, 2000). De Janvry, Fafchamps and Sadoulet (1991) interpreted market failure as a feature that is household – and not commodity – specific. Generally, the markets exist but too high transaction costs make it not profitable for particular households to participate in the market, making the commodity a nontradable for those households. Nonexistence of market is then the extreme case of market failure (De Janvry, Fafchamps and Sadoulet, 1991).

Various works on marketed surplus have particularly addressed the relation between transactions costs and marketed surplus of various commodities in various areas. In a pioneering study, Goetz (1992) used data collected during 1986-87 in 12 villages and 142 households in southern Senegal and estimated a selectivity model of coarse grains market participation and amount traded. Considering the fact that transaction costs drive a wedge between prices received by sellers and paid by buyers (De Janvry, Fafchamps and Sadoulet, 1991), this study breaks the household market participation decision into two separate decisions. First, the households decide whether or not to participate in the market, then they decide how much to supply to the market conditional on participation. Goetz (1992) found that transactions costs significantly hindered, while better information stimulated smallholder market participation. But Goetz didn't distinguish between fixed and proportional transaction costs. According

to Key et al. (2000), Goetz identified the role of proportional transactions costs but not of fixed transaction costs.

Key et al. (2000) expanded on Goetz's model by separately identifying the role of proportional and fixed transactions costs in the household supply decision and separately testing for the importance of these transactions costs in the estimation. Proportional transactions costs (PTC) raise the price effectively paid by a buyer and lower the price effectively received by a seller. PTCs include per-unit costs of accessing markets associated with transportation, marketing and imperfect information, many of whom are unobservable or cannot be easily recorded in a survey. On contrary, fixed transactions costs (FTCs) are invariant to the quantity of a good traded and may include the costs of searching for a customer or salesperson with the best price, or search for a market; negotiation and bargaining; and screening, enforcement, and supervision. Key et al. (2000) used a selectivity model that separate market participation decision from quantity supplied to the market. They found that fixed transactions costs influence only the decision of participation, and variable transactions costs can influence both decisions. The empirical model, estimated using data on corn producers in Mexico, showed that proportional transactions costs are important in selling and fixed transactions costs matter for both sellers and buyers. In addition they found that 60% of the response to an increase in the sale price is due to producers who enter the sales market, while the remaining 40% is due to the response of those who are already sellers. This result suggests the importance of taking proper account of market participation decisions.

Alene, et al. (2008) assessed the effects of transactions costs, relative to price and nonprice factors on output marketed supply and input use among maize producers in Kenya. The study built on the work on the effects of transaction costs of Key et al. (2000), and also modeled input and output marketing decisions as two-step decision processes. First, the household decides whether or not to participate in the market, and second the household decides on the volume of transactions. Following the same approach as Key et al. (2000), Alene et al. (2008) used a selectivity model that accounts not only for the effects of fixed and variable transactions costs but also for the role of assets, technology, and support services in promoting input use and generating a marketable surplus. Output supply and input demand responses to changes in transactions costs and price and non-price factors were estimated and decomposed into market entry and intensity. The results indicated that while transactions costs indeed have significant negative effects on market participation, institutional innovations—such as group marketing—are also emerging to mitigate the costs of accessing markets. Output price was found to have no effect on output market entry and only provides incentives for increased supply by sellers.

Within the framework of selectivity models, Ouma et al. (2010) use the Heckman procedure to analyze the way transaction costs affect smallholder farming households' participation in banana markets in the Great Lakes region of Central Africa. The results indicate that fixed transaction costs largely determine a farmer's decision to participate in the market, and proportional transaction costs largely affect the extent of participation. Therefore, access to market information, whether directly or through formal or informal institutional arrangements, is critical for market participation. Their study concluded that policies aimed at encouraging market information access, investments in rural infrastructure and collective action by farmers may help to lower transaction costs and thus enhance market participation.

More recent work by Azam et al. (2012) examined agricultural supply response and smallholders market participation, using household data collected for Cambodian Socio-Economic Survey -2004 (CSES) and CSES – 2007. As in Goetz (1992) and Key et al. (2000), their conceptual framework separated household market behavior into two decisions namely the participation and the quantity supplied. They also differentiated between fixed and variable transaction costs and estimated their effects separately. The empirical model was estimated using the Heckman two-stage selection procedure. Here also, transaction costs were found to significantly inhibit farmers' market participation and marketed surplus. In general, the findings indicate that non-price factors such as risk, technology and rural infrastructures are important determinants of commercialization of agriculture in Cambodia.

Transaction costs affect not only farmers' decision to participate to the market but also their decision about whether they should sell their produce at the farm gate or travel to the market where they can get a higher price but must incur a transportation cost. This aspect was studied by Fafchamps and Hill (2005) using data collected from coffee producers in Uganda. They found that when farmers have to walk their coffee to the market, wealthier farmers – who are assumed to have a higher opportunity cost of time – are less likely to bring their produce to the market. But when farmer have access to public transportation systems, wealthier farmers are more likely to sell to the market. In general, the main results of the study indicated that farmers are more likely to sell their produce to the market when the quantity sold is large, the market is close by and they have low reference value for their time (Fafchamps and Hill, 2005). Those conditions basically reduce the transaction costs per unit of agricultural produce sold which means that transaction cost is the main determinant of the decision of farmers to sell at farm gate or not.

2.3.4. Others determinants of marketed surplus

Apart from prices, transaction costs and output, most of the studies on marketed surplus have showed that many households' characteristics significantly affect the size of marketed surplus. Based on descriptive statistics, Upender (1990) showed a positive relationship between marketed/marketable surplus and the size of farm. He also found that larger family size is associated with higher retentions for home consumption, thus lowering marketed surplus. But descriptive statistics only show correlation and not necessarily implies a causal relationship between the variables.

Also Ouma, et al. (2010) used econometric model and found a positive relationship between a member of a household belonging to a farmer group and the likelihood of that household participating in banana markets as a seller in central Africa. This confirms that farmer groups can be good platforms for exchanging information, enabling farmers to link to buyers at a lower cost and thereby lowering the fixed transaction costs of market participation. They also found that the size of the household and ownership of means of transport are critical in determining the intensity of market participation. The geographical location of the household affects market participation, since some locations have better infrastructure and hence are more commercialized.

In an effort to help better identify what interventions are most likely to break smallholders out of the semi-subsistence poverty trap, Barrett (2008) reviewed the evidence on smallholder market participation, with a focus on staple foodgrains (i.e., cereals) in eastern and southern Africa. His study pointed out that some complementary policy actions are needed to address market imperfections, such as the entry barriers that inhibit smallholder market participation. Indeed, interventions

aimed at facilitating smallholder organization, at reducing the costs of intermarket commerce, and at improving poorer households' access to improved technologies and productive assets are central to stimulating smallholder market participation and escape from semi-subsistence poverty traps. Without such complementary policy actions, macroeconomic and trade policy tools are less likely to be useful in inducing market participation by poor smallholders in the region. Small farmers are less responsive to price incentives because they lack production inputs and technologies to take advantage of the opportunity created by those policies and market supply of well established farmers increase without increasing smallholders' market participation.

2.4 AGRICULTURAL HOUSEHOLD MODEL AND FARMERS' MARKET PARTICIPATION

We have argued that agricultural households, such as rice producers in Togo, have special characteristics and cannot be strictly classified either as producer, or as consumer. They are actually both producers, choosing the allocation of labor and other inputs to crop-production, and consumers, choosing the allocation of income from farm profits and labor sales to the consumption of commodities and services. The agricultural household models (AHM) better model such households' decision making by resolving the contradiction of positive own-price elasticity of demand for food, as well as the problem of sluggish marketed-surplus responses to food-price changes that can be observed (Taylor and Adelman, 2003). And this is important because using the right economic model has considerable implication for the success of policy decision making.

The main goal of the agricultural household is to maximize a discounted future stream of expected utility from a list of consumption goods including home-produced goods, purchased goods, and leisure, subject to some constraints that include cash income, family time and endowments of fixed productive assets, and production technologies and prices of inputs, outputs, and non-produced consumption goods (Taylor and Adelman, 2003). But most AHM don't incorporate the future stream of utility. They are mostly static and ignore several important aspects of household's decisions, notably the role of risk and annual credit constraint (Key, Sadoulet and Janvry, 2000).

AHMs have many empirical applications and a very large range of policy issues have been investigated using this general framework. Singh et al (1986) reported the results of empirical applications of the model to investigate various policy issues – such as the welfare of farm households, the size of marketed surplus, the demand for nonagricultural goods and services, and for hired labor, and the availability of budget revenues and foreign exchange; in different areas of the world – such as in India, Indonesia, Japan, the Republic of Korea, Malaysia, Nigeria, Senegal, Sierra Leone, Taiwan, and Thailand. The early uses of the AHM were focused primarily on price policy. The general result from the geographically diverse econometric studies conducted on the subject is that an increase in the price of a crop increases production of that crop and induces a positive consumption effect as well, with the consumption effect large enough to dampen the increase in marketed surplus of the crop whose price rose (Taylor and Adelman, 2003). Taylor et al. (2003) reported also the results of applications of the AHM to other policy topics such as off-farm labor supply, technology policy, nutrition policy, downstream growth, labor supply, migration, income distribution, savings and family planning.

In the following section we present briefly the theory about the SCP paradigm since we will be using the concepts of concentration ratio and market margins to analyze the structure and performance of rice marketing in Togo as part of our second objective.

2.5. THE STRUCTURE-CONDUCT-PERFORMANCE (SCP) PARADIGM

Developed by Joe Bain and Edward Mason the SCP paradigm is recognized as one of the most efficient and reliable means to analyze the market power-profitability relationship in an industry and was extensively used for studying industrial organization during the second half of the 20th century (DeLorme *et al.*, 2003; Grigorova, Muller and Huschelrath, 2008). Theoretically, the SCP paradigm implies a relationship between the 3 components of the paradigm namely structure, conduct and performance (Waldman and Jensen, 2007): Market structure or the distribution of the power between players in an industry influences the behavior (conduct) of those players in the industry, which in turn influences the performance of the industry. In addition, there is a reverse relationship between the components such that market structure is also influenced by market performance, either directly or through market conduct. All these happen in an environment largely shaped by exogenous factors such as government policies (including regulation and fiscal policies)

The relationship between the components of the SCP paradigm has been examined empirically by analysts for various industries in different areas of the world since 1940s. For example, Grigorova et al. (2008) used the SCP paradigm to analyze the mobile telecommunications industry for the years 1993-2006 in Bulgaria. The first SCP models considered a one way relationship between the market structure and market performance through market conduct. Structure was assumed to be exogenously determined by supply and demand conditions. Even some analysts such as Bain (1951) claimed that market structure influence directly market performance without going through market conduct. This is called the concentration-profit or structure-performance hypothesis (Bain, 1951) p294:

"...the average profit rate of firms in oligopolistic industries of a high concentration will tend to be significantly larger than that of firms in less concentrated oligopolies or in industries of atomistic structure"

But the more recent literature has considered the reciprocity between the different components of the SCP paradigm. And many empirical studies have used econometric models to investigate these relationships between the components of the SCP paradigm. Following the same approach as Delorme et al. (2003) who studied the relationship between structure, conduct and performance in US manufacturing in the 1980s and 1990s, Tung et al. (2010) used Kambhampati's (1996) simultaneous equation framework to estimate causes and effects among the taiwanese international tourist hotel industry. The results of the study of Tung et al. (2010) confirm a simultaneous relationship between market share and advertising. In particular the study found a positive response of market share to advertising, but a negative effect of advertising on market share. Also, high market share was found to result in higher profits.

As far as DeLorme et al. (2003) is concerned, the findings of the study contradicts some aspects of the SCP paradigm and support some others. First, the data suggest that industry structure does not depend on current industry performance. Second, little evidence is found that industry conduct, proxied by advertising, is affected by industry structure. Third, results show that industry performance does not depend on industry conduct, though it is sensitive to industry structure.

Even though the SCP paradigm was mostly used for analyzing more industrial sectors, there are some applications to the agricultural marketing sector in developing countries. In general, structure and performance of agricultural markets, especially food markets, have important implication for food security in developing countries. Theoretically, when structure is competitive, traders make lower profits, market margins are lower, and therefore agricultural households receive a higher share of the retail price than under conditions with more monopolistic structure. This basically means that under competition, farmers get more income that they can use to purchase more food commodities than under monopoly or oligopoly. Similarly, high competition in the market implies low consumer prices which means that with fixed amount of money, consumer get more food commodities under competitive structure than under monopolistic structure.

In West Africa, Onu and Iliyasu (2008) analyzed the food grain market in Adamawa State, Nigeria using the SCP paradigm framework. The results of the study indicate the presence of a large number of food grain traders which translates considerable competition in the market. Consistently with the structure-performance hypothesis, gross market margin was fairly low – about 13.9%, indicating that traders are not making too high profits. More recently, Shen (2011) analyzed Chinese agricultural market structure, conduct and performance and found that the structure-performance hypothesis also holds in the Chinese agricultural market. The Chinese agricultural market was found to be characterized by low concentration degree which leads to high competition and low profit margins.

CHAPTER III: METHODOLOGY

3.1. CONCEPTUAL FRAMEWORK

The conceptual framework adopted for this research study is directly based on the objectives of the current research. To study each objective we used different economic models and concepts and derived suitable empirical formulations to test the hypotheses associated with it.

3.1.1. Agricultural households and market participation

To analyze factors that determine farmers' decision to participate in the market—our first objective—we employ the Agricultural Household Model framework (Singh, Squire and Strauss, 1986; Lapar, Holloway and Ehui, 2003; Fafchamps and Hill, 2005; Alene *et al.*, 2008; Barrett, 2008). As indicated earlier, agricultural household models provide a framework for analyzing household behavior that integrates both the production and consumption decision which characterize agricultural households in developing countries (Singh, Squire and Strauss, 1986). In the current study, we assume that the rice producing households in Togo make combined production and consumption decision to participate in the markets often considered as a part of their decision making process to maximize their utility. Hence we model the Togolese farm-households' decision making process within the agricultural household framework as follow:

Each farm-household of our sample is assumed to have preference on food consumption C_F , non-food consumption or manufactured goods C_{NF} , and leisure C_L , defined by the utility function $U(C_F, C_{NF}, C_L)$. For simplicity we consider only rice as food consumption in our model. The household has also a production technology defined by the production function f(L, A) where L is the labor used in production and it includes both household labor H and hired labor h. A is the acreage of land and is assumed to be fixed. The household is endowed with a total amount of time T. The household uses labor L and other inputs X to produce a quantity of output Q_F . Wage rate is assumed to be W and price of commodity is P_i (i=F, NF, X).

The household problem is then:
Max $U(C_F, C_{NF}, C_L)$, subject to the following production, time and income constraints (respectively):

$$\boldsymbol{Q} = \boldsymbol{f}(\boldsymbol{L},\boldsymbol{X}) \tag{1}$$

$$T = H + C_L \tag{2}$$

$$P_F(Q_F - C_F) + W(H - L) = P_X X + P_{NF} C_{NF}$$
(3)

Equation 3 simply says that the marketed surplus value plus the marketed labor value must equal the consumption expenditure. Combining the 3 equations yields one full income constraint:

$$(P_F f(L, X) - P_X X - WL) + WT = \pi^* + W \times T = P_F C_F + P_{NF} C_{NF} + WC_L$$
(4)

Equation 4 says that household's total income (that includes farm profit and the value of the total time available to the household) equals total household consumption. Assuming the existence of an interior solution, the optimum set of quantities (C_F , C_{NF} , C_L , Q_F) are given by the solution to the following system of first order conditions:

$$\frac{\partial U}{\partial C_F} - \lambda P_F = \mathbf{0} \tag{5}$$

$$\frac{\partial U}{\partial C_{NF}} - \lambda P_{NF} = \mathbf{0}$$
 (6)

$$\frac{\partial U}{\partial c_L} - \lambda W = \mathbf{0} \tag{7}$$

$$\lambda \left[P_F \frac{\partial Q_F}{\partial L} - \mathbf{W} \right] = \mathbf{0}$$
(8)

$$\lambda \left[P_F \frac{\partial Q_F}{\partial X} - P_X \right] = \mathbf{0} \tag{9}$$

$$\pi^* + W \times T = P_F C_F + P_{NF} C_{NF} + W C_L$$
(10)

This household behavior can be decomposed into production and consumption decisions. As a producer, the household chooses the levels of inputs and outputs that satisfy equations 8 and 9 as well as the production function in equation 1. This is equivalent to maximizing a generalized profit function defined over rice which is assumed to be the only commodity produced by the household. This leads to a system of input demand and rice supply:

$$\boldsymbol{L}^* = \boldsymbol{L}(\boldsymbol{P}_F, \boldsymbol{W}, \boldsymbol{P}_X) \tag{11}$$

$$X^* = X(P_F, W, P_X) \tag{12}$$

As a consumer, the household chooses the levels of consumption which maximizes its utility under the full income constraint. Solving the system of first order conditions in equations 5, 6, 7, and 10, yield the demand functions of the following forms.

$$C_F^* = C_F(P_F, P_{NF}, W, P_X, Y^*)$$
(13)

$$C_{NF}^{*} = C_{NF}(P_{F}, P_{NF}, W, P_{X}, Y^{*})$$
(14)

$$C_L^* = C_L(P_F, P_{NF}, W, P_X, Y^*)$$
 (15)

Where
$$Y^* = P_F Q_F^* - P_X X^* - W L^* + W T$$
 (16)

Clearly, production decisions in such household models are independent of consumption decisions. However, consumption choices depend on production choices through Y*. This is called *separability* or *recursiveness*. Separability or recursiveness between production and consumption decision means that production decision does not depend on consumption decision. But, as shown in equations 13 to 16, consumption decision depends on production decision through income which is influenced by farm profit (Singh, Squire and Strauss, 1986). Separability holds under some restrictive assumptions such as complete and competitive markets (Benjamin, 1992). We assume that separability holds true in our model because market does exist for rice and labor in the study area and we consider that rice is the only one good produced by the household (partial equilibrium). The fact that market exists for rice and labor and that prices are exogenous to households allows the model to be recursive (Strauss, 1984). Separability would not hold if we were to consider a general equilibrium in which the absence of market for some other goods may affect supply and demand of the commodities and factors for which market does exist (De Janvry, Fafchamps and Sadoulet, 1991). Another reason why we felt confident to assume that separability hold is that Benjamin (1992) tested for separability in farm household in rural area and wasn't able to reject the null hypothesis.

The agricultural household model provides a useful benchmark to study the response of marketed surplus to changes in prices P_F . Following Strauss (1984), Goetz (1992), and Alene et al. (2008) we consider that marketed surplus M is equal to output produced less consumption:

$$M = Q_F - C_F \tag{17}$$

Now we use comparative statics to derive theoretical predictions about the effect of change in rice price on marketed surplus. Totally differentiating M with respect to C_F yields:

$$\frac{dM}{dP_F} = \frac{dQ_F}{dP_F} - \frac{dC_F}{dP_F}$$
(18)

From equation 13, we know that the second term of equation 18 can be expanded as followed:

$$\frac{dC_F}{dP_F} = \frac{\partial C_F}{\partial P_F}\Big|_{Y^* \text{ constant}} + \frac{\partial C_F}{\partial Y^*} \cdot \frac{\partial Y^*}{\partial P_F}$$
(19)

Equation 19 basically says that the response of consumption to change in price of rice has two components: a standard Marshallian price effect (first term) and a profit effect that extend the income effect (second term).

Since the equilibrium income is $Y^* = P_F Q_F^* - P_X X^* - WL^* + WT$ as given by equation 16, then:

$$\frac{\partial Y^*}{\partial P_F} = Q_F^* \tag{20}$$

Substituting equation 20 into equation 19 yields:

$$\frac{dC_F}{dP_F} = \frac{\partial C_F}{\partial P_F} \Big|_{\pi^* \text{ constant}} + Q_F^* \frac{\partial C_F}{\partial Y^*}$$
(21)

Therefore, substituting equation 21 into equation 18, we get:

$$\frac{dM}{dP_F} = \frac{dQ_F}{dP_F} - \frac{\partial C_F}{\partial P_F} \Big|_{\pi^* \text{ constant}} - Q_F^* \frac{\partial C_F}{\partial Y^*}$$

$$(22)$$

From standard producer theory, we know that the first term of equation 22 is necessary positive. Then we assume rice is a normal good. From standard consumer theory, the second term, which is the negative Marshallian price effect multiplied by a negative sign is also positive. But the last term is negative for the same reason that rice is a normal good. Consequently the overall sign of the equation is ambiguous. When prices increase, marketed surplus might fall or rise. If income elasticity of rice consumption is high enough, then the household's consumption response to price increase may outweigh its output response and marketed surplus will then actually fall. However, empirical evidence provided in Singh et al. (1986) showed that in most of the case, consumption response to price increase only dampens the elasticity of marketed surplus but does not reverse its sign. This implies that price of rice is likely to have a significant effect on rice marketed surplus in Togo. But the sign of the effect remains unpredictable and will need to be tested empirically

3.1.2. Concentration ratio

Our second objective is to study the structure of Togolese rice market by employing Structure-Conduct-Performance paradigm, which allows us to better understand the competitiveness and efficiency of the rice market. As mentioned in chapter 2, SCP paradigm implies a two way relationship within each pair of the three components of the paradigm in a way that the performance of an industry is influenced by the conduct of the industry, which on the other hand is determined by its structure (Bain, 1951; Tung, Lin and Wang, 2010). In this study we focus particularly on two components of the SCP paradigm, namely: the structure and the performance of the rice market structure viz., the conduct of rice markets in Togo due to data limitations.

The market structure could be measured using indices such as Concentration Ratio, Herfindahl-Hirschman Index (HHI), and Gini Coefficient (Bain, 1951; Miller, 1982). In this study we used concentration ratio to measure and analyze the degree of rice traders' concentration in the different markets of Togo. The choice of the concentration over the HHI and the Gini Coefficient can be justified mainly by the fact that the concentration ratio is very easy to compute and to understand.

Concentration ratio measures the degree of concentration within an industry, or the proportion of the combined production (or sale) volume supplied by a certain number of firms or traders (Bain, 1951). In our study, the concentration ratio was measured as the percentage of combined rice sales by a given number of lead firms in the Togolese markets. We calculated the four-firm concentration ratio (CR4) which considers the total market share of the four traders with the largest volume of sales in a given market. In this study, we consider each of the five regions of Togo as a big market, and rice sales of traders from each region account for rice sales in the market represented by that region. Theoretically, the higher the degree of concentration is, the greater the possibility of non-competitive behavior in the market.

high concentration ratio in the rice market in Togo, we can conclude that the market is not competitive and therefore will expect it not to be efficient.

3.1.3. Market margins

We also compute market margins to analyze the efficiency of rice marketing system in a further effort to better understand the structure of the market. A marketing margin is "... the percentage of the final weighted average selling price taken by each stage of the marketing chain" (FAO, 2007). Margin calculation requires the knowledge of average prices of rice at each level of the market chain between which the margins are to be estimated. Total Gross Market Margin (TGMM) is the ratio of the retail price that is taken by the whole market chain. Knowing the average price paid by the consumer per Kg of rice (retail price) and the average price received by the farmer per Kg of rice (farm price), we calculate rice market margin by dividing the difference between the retail and farm price by the retail price as follow:

$$TGMM = \frac{\text{Retail Price-Farm Price}}{\text{Retail Price}} \times 100$$
(23)

Where TGMM is Total Gross Market Margin; retail price is the price paid by the final consumer per Kg of milled rice and farm price is the price received by the producer per Kg of milled rice.

3.2. Empirical methods

The data collected from farmers and traders and other sources were analyzed using both descriptive statistics and econometric models. Descriptive statistics analysis refer to the use of ratios, percentages, means, variances, graphs and were used for examining and describing farm and traders household characteristics, resource ownership, market and traders characteristics, role of intermediaries, and market margins. As far as econometric analyses are concerned, the determinants of farmers' market participation decision were estimated using both Tobit regression and Heckman two-stage selection models. The statistical software program used for the different estimations is STATA 11.

3.2.1. Farmers' market participation analysis

Knowing what the dependent and explanatory variables are, we can use econometric model to analyze the factors that affect rice famers' marketed surplus decision in Togo. Ideally, OLS regression model is applicable when all the sample households participate in the market. But that's not the case here. Not all households participate in the rice market and the quantity of rice supplied to the market is only observed for people who do participate in the market. Many reasons can justify why some households don't participate in the market while others do. For example, some households may not prefer to participate in a particular market in favor of another, while others may be excluded by market conditions. If the OLS regression is estimated excluding the nonparticipants from the analysis, a sample selectivity bias is introduced into the model leading to a bias and inconsistent estimate. To overcome such problem, most empirical studies on output marketed supply or input demand have used the famous Heckman's (1976) sample selection model (Goetz, 1992; Heltberg and Tarp, 2002; Alene *et al.*, 2008), while some others used the Tobit model, to analyze output marketed supply (Holloway *et al.*, 2000; Holloway *et al.*, 2004).

In this study, both the Heckman two-stage selection model and Tobit (censored regression) model are estimated and the results are compared for robustness check.

3.2.1.1. Tobit regression

In general, the Tobit model is appropriate when the dependant variable is censored at some upper or lower bound. In our study, the dependant variable which is market supply of rice is left-censored (censored at a lower bound) at zero. The model can be specified as follow (Holloway *et al.*, 2000):

$$Y_i^* = X_i \beta_i + e_i, i = 1, 2, 3... n$$
 (24)

where Y_i^* is the dependant variable representing the quantity of rice supplied to the market by the ith rice producer. Y_i is the observed variable and Y_i^* is the unobserved latent variable such that Y = Y_i^* , if $Y_i^* > 0$, and Y=0 if $Y_i^* \le 0$, which means Y = max (Y_i^* , 0);

X_i is the vector of explanatory variables including the intercept

 β_i is the vector of regression coefficients that depicts the relationship between the dependant and explanatory variables

 e_i is unobserved error term assumed to be independently and identically distributed following $N(0, \sigma^2)$.

The model parameters are estimated by maximizing the likelihood function of the following form:

$$L = \prod_{Y_i^* > 0} \frac{1}{\delta} f \frac{(Y - X_i \beta_i)}{\delta} \prod_{Y_i^* \le 0} F \frac{(-X_i \beta_i)}{\delta}$$
(25)

Where f and F are respectively, the density function and cumulative distribution function of Y_i^* .

The disadvantage about the Tobit model is that it assumes that both the participation decision and level of supply are determined by the same variable in the same way. This means that a variable that affect farmers' decision to participate into the market also affects the quantity supplied to the market in the same way. But in reality all producers may not be potential suppliers of rice and a variable that affect participation decision may or may not have similar effect on the volume of rice supplied to the market. This problem can be fixed by using the Heckman two-stage selection model which estimates the market participation decision and market supply decision separately.

3.2.1.2. Heckman two-stage regression

In the Heckman two-stage selection model, factors affecting households' decision to participate in the market are first identified using a Probit regression model, from which the Inverse Mill Ratio (IMR) is estimated. Then, in the second stage, market surplus function is estimated using an OLS regression model, and including the IMR as an explanatory variable to account for selectivity bias.

The probit model is specified as follow:

$$Prob(Y_i = 1) = Prob(Y_i^* > 0) = z_i \gamma_i + \varepsilon_i$$
 $i = 1, 2, 3, ..., n$ (26)

Where Y_i is a dummy variable representing rice market participation, taking the value 1, when the respondent is participating in the market, i.e. he sells a positive quantity of

his rice production; and zero otherwise. Y_i^* is the latent supply if a household is a seller and it is observed only when it is greater than zero.

 z_i is the vector of independent variables (including the intercept) which determine whether a household is engaged in selling rice in 2009 or not,

 γ_i is the vector of regression coefficients

 ε_i is unobserved random error term assumed to be independently and identically distributed following N(0, 1).

From this Probit estimation, the IMR, denoted by λ_i , is generated and introduced as an additional regressor in the market supply function. This way, the parameters of the market supply function can be consistently estimated by OLS regression model. More precisely, this OLS regression, representing the second step of the Heckman's two-stage selection model is specified as follow:

$$Y_i^* = X_i \beta_i + \mu \lambda_i + \eta_i$$
, $i = 1, 2, 3, ..., n$ (27)

 Y_i^* is rice sales of a producer household in 2009

X_i is the vector of explanatory variables (including the intercept) which affect rice sales

 β_i is the vector of coefficients estimates of the independent variables

 η_i is unobserved error term assumed to be independently and identically distributed following $N(0, \sigma)$.

As part of our second objective we calculated the concentration ratio for each region of Togo to evaluate the structure of the rice market in each region. Then we calculated the market margins to measure the efficiency of the markets in each of the five regions of Togo.

3.2.2. Concentration ratio

The computation of the concentration ratio for the rice market in Togo was pretty straightforward. During the consumer preferences survey, information was collected about the quantity of rice traded weekly by each trader of our sample. Using that information, we calculated for each trader, his share w_i of the volume of rice traded in

his region. Then we computed in each of the 5 regions of Togo the four-firm concentration ratio CR_4 – cumulative share of the 4 largest traders in the region – using the following formula:

$$CR_4 = w_1 + w_2 + w_3 + w_4 \tag{28}$$

3.2.3. Market Margins analysis

The formula for the calculation on market margins requires two main components: the farm price of rice and the retail price. But, the calculation of margins, for products such as paddy rice that require primary processing, is a bit particular and follows some specific rules (FAO, 2007). The price received by the farmers in real is usually the price of the paddy rice. But the retail product is the processed rice. And the transformation of rice from paddy form to white rice form clearly involves costs directly associated with the operation of the processing facility. In addition to this, there are two other important aspects of processing costs. First, conversion from paddy to white rice doesn't happen with a 100% rate. Conversion rate tells how much rice will be obtained if one kg of paddy rice is processed. Secondly, there may be a by-product as a result of the processing. Therefore we need to take into account the costs of processing of the rice, the conversion rate, the quantity of by-product, and the value of that by-product, in order to estimate the farm price. The formula suggested by FAO (2007) for doing so is the following:

$$Farm Price = \frac{-Value \text{ of by products}}{Paddy Conversion Rate}$$
(29)

In our study, the value of by-products collected from paddy rice processing is assumed to be zero because Togolese farmers don't sell them usually. However in many cases, they are used for animal feeding and a more accurate calculation would have suggested taking this into account. Besides, we chose rate of conversion from paddy rice to milled rice to be 70% as suggested in general by FA0 (2007) and as confirmed by the data collected from processors in the study area.

In order to understand better the findings of the market participation analysis and market margins analysis, we also conducted a descriptive analysis of the constraints faced by rice producers and rice traders in Togo, as it is the third objective of our study. This analysis helped us rank the constraints faced by respondents according to their importance. We present here the method used for analyzing the constraints.

3.2.4. Analysis of constraints among actors in the rice value chain

As part of the consumer preference survey, rice producers and traders in Togo were asked to rank the 3 main constraints they were facing in their activity. Then in our analysis, we established first a list of all the constraints. Then we computed a score for each constraint that takes into account how many times it was ranked first, second, and third. In particular, for each respondent, a constraint was given score 3 when it is the 1st main constraint, score 2 if it was the 2nd main constraint, and score 1 if it was the 3rd main constraint. Therefore, total score of each constraint of the global list of constraints is given by:

 $S = 3 \times R_1 + 2 \times R_2 + 1 \times R_3$, where R₁, R₂, and R₃ represent the number of respondents who ranked the constraint in question 1st, 2nd, and 3rd respectively.

Those score S were then used to rank globally the constraints faced overall by producers and traders in Togo.

Before presenting the results of our study, we provide in the following section a description of the kind of data used in our analyses, the sampling method used to select the respondents farmers and traders, as well as the variable used in our econometric analysis.

3.3. ДАТА

This study was conducted using information collected from both primary and secondary sources. Primary data were collected during the "Consumers Preferences Survey" implemented in 2010 by AfricaRice Center in the 5 regions of Togo. The survey used 4 types of structured questionnaires, one for each of the main actors involved in the rice value chain in Togo namely: the paddy producers, the processors, the traders and the consumers. But the present study used only the information collected from producers and traders. Information collected from farmers focused on the overall socio economic characteristics of the sample households, production techniques, production constraints, management of the production, annual income from farming and non farming activities, marketing strategies, amongst others. The

questionnaire for traders covered the overall characteristics of the traders, the sources of provision, the market links, the marketing costs, the marketing constraints, the access to credit, etc.

Secondary data on the description of the study area and also the yearly lagged prices of rice at national, regional and prefectural levels were collected from DSID (Direction des Statistiques agricoles, de l'Informatique et de la Documentation), and OSAT (Observatoire de la Securité Alimentaire du Togo). Data was also collected from FAOSTAT and the World Bank websites.

3.3.1 Sampling

The final sample consisted of information gathered from 253 farm households and 194 traders from the five main regions of Togo viz., *Maritimes, Plateaux, Centrale, Kara and Savanes*. The sampling of regions and sub-regions along with the number of farmers and traders included in the survey were determined in consultation with the local extension workers, based on the concentration of rice growers and traders in each region. From a list of rice producers and traders in each village, samples were drawn randomly to represent the final sample.

The sampling distribution of farmers and traders across regions and sub-regions are presented in the table 1.

Regions	Prefectures	Number of farmers	Number of traders
Maritime	Afagnan	9	-
	Golfe	-	34
	Lacs	-	17
	Zio	70	5
	Total	79	56
Plateau	Agou	2	-
	Kloto	1	20
	Kpele-Akata	17	-
	Wawa	12	10
	Total	32	30
Central	Tchaoudjo	10	15
	Tchamba	10	15
	Sotouboua	20	10
	Total	40	40
Kara	Kozah	24	20
	Binah	12	15
	Bassar	15	3
	Total	51	38
Savanes	Tone	19	8
	Cinkassé	12	12
	Kpendjal	20	10
	Total	51	30

Table 1: Distribution of the sample respondents by region and prefecture

Source: Consumer Preferences Survey (AfricaRice Center, 2010)

3.3.2. Variables

In this section, we present various factors that potentially influence farmers' decision to participate in the market and the amount of rice supplied in the Togolese markets. The variables used in our model are drawn from the review of the literature on market participation and marketed surplus summarized in chapter 2. We hypothesize four main categories of variables may influence Togolese farmers' market participation behavior. First we consider household characteristics such as education, gender and age of the household head, as well as size of the household, and the share of rice in the household's total income. Second we consider market related variables namely price of the paddy rice in the prefecture, the quantity of rice produced by the household, and whether the household head is a farmer-trader or not. Third we consider the household social network basically captured by the household head's membership to a farmer association. Finally we considered the geographical location effects since the five regions in Togo are not endowed evenly with transport and communication infrastructure which is likely to influence differently transaction costs and affect differently farmers' market behavior. The outcome and explanatory variables used in this study are described below in the table 2. Further we discuss the definition of each of these variables that were computed from the data collected through the consumer preference survey conducted by Africa Rice Center in Togo in 2010.

VARIABLE	DEFINITION OF	UNIT OF	HYPOTHESIZED						
NAME	VARIABLES	MEASUREMENT	SIGN						
	Dependent or outcome	variables used							
Market	Dummy variable								
Participation	representing whether the	yes=1; No=0							
	respondent had sold a								
	positive quantity of his rice								
	production in the year 2009								
	or not								
Quantity	Continuous variable								
Supplied	representing the amount of	tons							
	paddy rice sold by the								
	farmers' household in 2009								
Explanatory variables									
Household characteristics									
Education of	Dummy variable indicating		+						
the household	whether the household head	yes=1; No=0							
head	has some formal education	•							
	or not								
Gender	Dummy variable indicating		+/-						
	whether the household is	yes=1; No=0							
	male-headed or not								
Age of	Continuous variable		+/-						
household	indicating the age of the	years							
head	household head. Used as								
	proxy measure of farming								
	experience of household								
	head.								
Size of the	Continuous variable that		+						
household	represents the total number	people							
	of people who belong to the								
	household.								

Table 2: Description of the variables

Share of rice	Continuous variable that		+
in household	measures the relative	percent	
total income	importance of rice		
	commercialization in the		
	household's income		
Market related	characteristics		
Paddy	Continuous variable		+
production	indicating the quantity of	tons	
	paddy rice produced by the		
	household in the year 2009		
Farmer trader	Dummy variable indicating		+
	whether the respondent rice	yes=1; No=0	
	producer is also a part time		
	trader or not		
Price of paddy	Continuous variable		+/-
rice	indicating the average price	FCFA	
	of paddy rice at the		
	prefectural level in the year		
	2009		
Social network			
Farmer	Dummy variable indicating		+
association	whether the respondent is a	yes=1; No=0	
membership	member of a farmer		
	association and 0 otherwise.		
Geographical le	ocations		
Location	These are 5 dummy		+/-
dummies	variables, one for each of	yes=1; No=0	
	the 5 regions in Togo,		
	indicating whether the		
	household is located in that		
	region or not		

As mentioned above, the hypothesized variables listed in the table as potential determinants of market participation and marketed surplus have been chosen based on the available theoretical and empirical literature on the subject. We describe here the rationale for including the above variables as well as the sign we are expecting for their estimated coefficients.

Household characteristics

Education of the household head is a dummy variable that refers to whether the head of household has received some formal education or not. It takes a value EDU=1 if

the head of household has a formal education and EDU=0 if the farmer doesn't have any formal education at all. Education increases farmer's ability to get and make appropriate use of information on better production practices and market opportunities. By improving access to information, education is likely to reduce fixed transaction costs and therefore improve market participation (Ouma *et al.*, 2010; Azam, Imai and Gaiha, 2012). Therefore this variable is expected to be positively correlated with market participation and marketed surplus.

Gender is a dummy variable that represents the sex of the head of household. It takes the value SEX=1 if the head of household is male and SEX=0 if the head of household is female. The effect of this variable on market participation is ambiguous. Alene *et al.* (2008) found that female-headed households have a greater likelihood of participation in maize markets than male-headed households. But they found that this variable had no effect on farmers' marketed surplus.

Age is a continuous variable measured in years, which represents the age of the household head. It is used as a proxy measure of farming experience of household head. The effect of this variable is ambiguous. Aged household heads are believed to be more efficient in resource use, and this variable is then expected to have a positive effect on market participation and marketed surplus. However, it can also have a negative impact because young people are assumed to be more dynamic than older people in their ability to get information on the market; and old people are usually more risk averse and reluctant to adopt new technologies. Alene *et al.* (2008) found that market participation declines with age, but age has no effect on marketed surplus once the farmer has decided to participate to the market.

Size of the family is a continuous variable that represents the total number of people who belong to the household. Even if a large household is likely to retain more of their rice produce for own consumption by the household members, therefore reducing marketed surplus, it has more family labor available to drive up output and also to help in the commercialization of rice. Empirical evidence has shown a positive impact of this variable on marketed surplus (Alene *et al.*, 2008; Ouma *et al.*, 2010). Therefore we are expecting a positive sign from this variable.

Share of rice in annual income is a continuous variable that takes values between zero and 1 and which measures the relative importance of rice commercialization in

the household's income. We assume that when the household does not produce many other cash crops and does not have many other opportunities or ways to make cash, income from rice sales would have an important weight in the household income. Therefore the household would rely more on rice to meet its cash requirements which is very likely to drive up their incentive to participate to rice market. Therefore, this variable is also expected to positively affect market participation and marketed surplus.

Market related variables

Output of paddy rice is a continuous variable measured in tones of paddy rice that indicates the quantity of paddy rice produced by the household in the year 2009. This variable was directly measured by asking the rice producers the quantity of paddy rice they harvested from all the plots cultivated with rice in 2009. According to the economic theory and the empirical evidence in the literature, farmers who produce higher output are expected to supply more to the market than those with lower output (Bardhan, 1970; Chinn, 1976; Upender, 1990). Therefore this variable is expected to have a positive impact on market participation.

Price of paddy is a continuous variable measured in FCFA per Kg of paddy rice, which represents the average price of paddy rice at the prefectural level at the moment of the survey. The expected effect of this variable on farmers' market participation behavior is ambiguous. According to the economic theory on agricultural household model, an increase in output price induces a profit effect that extends the income effect. Therefore if income elasticity of rice consumption is high enough, then the household's consumption response to price increase may outweigh its output response and marketed surplus will then actually fall. Otherwise marketed surplus falls or remains constant (Singh *et al.*, 1986; De Janvry, Fafchamps and Sadoulet, 1991; Taylor and Adelman, 2003). Also empirical evidence have shown both negative price reponse (Bardhan, 1970; Goetz, 1992) and positive price response (Strauss, 1984; Ouma *et al.*, 2010) of marketed surplus. Therefore the sign of this variable is unpredictable in our case.

Farmer-trader is also a dummy variable used to capture the effect of transaction costs on market participation. This variable indicates whether the respondent rice producer is also a part time trader. Being a part time trader means that the rice

producer owns a trade business where he buys and resells other products (including rice or not) beyond his own agricultural production. Smale et al. (2009) notice the presence of a lot of such farmers-traders in the seed markets in Kenya and Mali. The variable takes the value of 1 if the respondent is also a part time trader and 0 otherwise. As trader, the respondent is supposed to have a better connection and more information on the market because he is already involved in marketing activities. This will certainly reduce the fixed cost on market participation and may be reduce also the variables costs. Therefore, this variable is expected to have a positive impact on market participation and marketed surplus.

Social network

Membership to a farmers' association is a dummy variable that takes the values of 1 if the respondent is a member of a farmer association and 0 otherwise. This is the second variable used to capture fixed transaction costs in our model. The membership to a farmers' association is assumed to expose the farmer to a bunch of information about better production technologies and market opportunities, enabling farmers to link to buyers at lower cost and thereby lowering the fixed transaction costs of market participation. This has been confirmed by empirical evidence such as Ouma, et al. (2010). Therefore, this variable is expected to affect market participation and marketed surplus positively.

<u>Geographical location</u>

We have included 4 location dummies for 4 out of the 5 regions in Togo namely *Savanes, Kara, PLateaux, and Maritimes* regions. The *Centrale* region is left to serve as basis for the location dummies. These dummy variables are expected to capture the difference across regions in terms of markets conditions such as infrastructure facilities that potentially affect farmers' market participation behavior through transaction costs. Ouma, et al. (2010) found that households in regions characterized by poor infrastructure, relatively low economic activity and political conflict are less likely to participate to the market.

CHAPTER IV: RESULTS AND DISCUSSION

In this chapter, we present the results from various quantitative and qualitative economic analyses conducted to assess the efficiency and performance of rice marketing chain in Togo. We first summarize the economic and demographic characteristics of farmers and traders sampled for the purposes of the study. Second, we discuss the empirical results from econometric analysis that was conducted to determine farmer's decision to participate in the market and the factors affecting the quantity of rice supplied by them in the Togolese markets. We also performed few analyses that describe the structure and the performance of existing rice market chain along with its actors for rice in Togo. A simple analysis on the market margins obtained by different actors in the rice value chain is also presented. Finally we described the constraints faced by rice producers and traders in Togo.

4.1. SOCIO ECONOMIC CHARACTERISTICS OF SAMPLE FARMERS AND TRADERS

4.1.1. Demographic characteristics of sample farmers

As hypothesized in the previous chapter, few household demographic characteristics such as gender, age, education and marital status of the household head along with the household or family size primarily influences both production and marketing decisions of the household. Table 3 summarizes the socio economic and demographic characteristics of the farmers sampled across the regions for this purpose. As indicated in the table, 92% of the sample households are male-headed and as such there is no significant difference across the regions in the proportion of male headed households in our sample.

The average age of the household head across the regions is about 44 years with significant variation across regions, ranging from 39 years in *Maritimes* region to about 50 years in *Savanes* region. This indicates that most of the rice farmers are well experienced in farming and their market participation behavior is relatively inelastic under constant market conditions. The F-test is significant at 1% which indicates that there is significant variation across regions in terms of age of the household head. This is very likely to induce variation in farmers' market behavior across regions. Regions where farmers are much older may have lower rate of market participation if the

characteristics of older farmers, such as risk aversion and reluctance to adopt technology and hence inability to produce for the market, outweigh the expected greater market contacts and trust that would allow them to trade at lower costs (Alene *et al.*, 2008).

Most of the farmers are long term residents of their primary village, with an average residency rate of about 34 years. Therefore they are very well integrated to their area and they are not expected to change their market participation behavior in the short run if the conditions of the area remain unchanged. As far as the marital status is concerned, almost 88 % of the respondents were married. This percentage is particularly high in the *Centrale* region where 100% of the respondents were married.

Variables			R	legions			
	Maritimes	Plateau	Centrale	Kara	Savanes	Total	F test
Number of	78	32	40	50	50	250	
observations							
Mean Age	39.6	46.3	44.6	43.8	49.8	44.1	6.6***
	(11.5)	(9.1)	(10.3)	(10.8)	(14.0)	(11.9)	
Household size	4.9	5.6	7.8	5.8	7.1	6.1	9.8***
	(2.9)	(2.04)	(3.6)	(2.3)	(2.7)	(3.0)	
Male-headed	91.0%	84.4%	97.5%	100%	86%	92%	
households							
Marital status							
Single	20.5%	15.6%	0%	12%	8%	12.4%	
Married	79.5%	84.4%	100%	88%	92%	87.6%	
Formal education	85.9%	71.9%	77.5%	84.0%	44.0%	74.0%	
Member of a farmer	1.5%	55.5%	14.8%	22.5%	28.3%	20.1%	
association							
Number of Years of	31.8	27.9	33.1	34.1	38.4	33.3	3.02**
residency	(13.8)	(17.1)	(15.1)	(13.6)	(16.0)	(15.1)	
Agriculture as	92.3%	84.4%	92.5%	82.0%	98.0%	90.4%	
primary activity							
Commerce as	5.1%	6.3%	2.5%	14.0%	20.0%	9.6%	
primary or secondary							
activity							
Household producing	87.2%	96.9%	97.5%	98.0%	94.0%	93.6%	
other cereals than							
rice							

Table 3: Socio economic characteristics of sample far	mers
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Figures in brackets (.) indicate the deviation from the mean of the variable measured.

***, **, and * indicate statistically significant at 1%, 5%, and 10% respectively

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010).

The average household size was about 6 members per family. This number varies from 4.9 in *Maritimes* region to 7.8 in the *Centrale* region. The F-test indicates significant difference in the number of members of family across regions. This is likely to affect farmers' market behavior across region. As mentioned in chapter 3, size of households may influence positively or negatively market participation depending of the balanced effect on consumption and production. A relatively high education rate was observed from the sample. Almost 75% of the surveyed household heads have some formal education through schooling experience and could read and write. This is consistent with the relatively high estimate of educations (QUIBB, 2006) which estimated the net rate of schooling in the primary level to be as high as 73 % in 2006. This may be explained by the fact that contrary to its nearby countries of Sub-Saharan Africa, Togo offers a better system of education to its citizens (MERF-TOGO, 2009).

As for farmers' connection with different social networks such as farmers association or any other development activities, it was found to be as low as 20 % among the surveyed regions and participants. As hypothesized in chapter 3, this variable affects fixed transaction costs of participating to the market and improves farmers' participation to the market. Low participation to farmers' association may indicate low access to information and this is very likely to influence negatively the market behavior of Togolese farmers. However there are wide differences across region in terms of membership to farmers' association. A relatively higher membership rate (56%) was observed in *Plateaux* region whereas the *Maritimes* region registered a very low participation rate – as low as 1.5 %.

Almost 90 % of the sampled farm households considered agriculture as their primary occupation. *Savanes* region had the highest proportion of agricultural households (98 %) compared to other regions. This may be probably due to diverse range of crops produced to avoid crop failure risk by the farmers in this region. Indeed, *Savanes* remains one of the regions greatly influenced by climate change, where the problems of flood, drinking water, erosion of grounds, drought, act as impediment to the development (MERF-TOGO, 2009). In general, the study results revealed that, overall in Togo, more than 90% of the sample farmers produce other cereals besides rice.

Trading is the secondary activity practiced by many of the farm households in the sampled regions. The results of the study revealed that overall, 9.6% of the sample farmers are also involved in trading activities, selling other products including rice or not, beyond their own household produce. In *Savanes* region, this rate is 20% whereas in *Centrale* region, trading as an occupation accounted for 2.5% of the sample. Regions where higher proportion of farmers are also traders are likely to have higher rate of market participation since they have more connection and better access to information on the market.

4.1.2. Economic importance of rice among the Togolese households

Even though rice is not the only cereal produced by togolese farmers, still the contribution of rice in terms of food security and the commercial importance is substantial. We hypothesized that the importance of rice in the household total income is likely to influence the household market choices especially the marketed surplus. The descriptive results presented in table 4 indicate that the average annual revenue from rice production represents about 57% of the total income of the respondent households. The F-test indicates significant difference across regions for this variable. In *Maritimes* region in particular, more than 90% of the household income was contributed by rice production and commercialization. This denotes a great importance of rice in the economy of those households and is expected to influence significantly market behavior of respondents' households.

Rice producers in Togo have access to a wide range of traditional and improved varieties of rice seed, from which they choose few cultivars to suite their production and consumption preferences. Descriptive statistics in table 4 indicate that the farmers in Togo cultivate at least two varieties of rice in their farms. Farmers who cultivate two or more than two rice varieties represent nearly 58 % of the total sample. Farmers in *Maritimes* region seem to diversify more compared to farmers in the *centrale* region. This may be due to the diverse range of consumption preferences that exist among consumers especially in the regions such as *Maritimes* where urban population is higher.

Variables		Regions					
	Maritimes	Plateau	Centrale	Kara	Savanes	Total	F test
Number of	78	32	40	50	50	250	
observations							
Rice alone as	87.2%	96.9%	97.5%	98.0%	94.0%	93.6%	
cereal produced							
(% of No)							
Importance of rice	92.6	46.7	35.0	52.3	50.1	57.1	56.54***
in household	(14.7)	(21.5)	(19.6)	(25.9)	(24.0)	(29.4)	
annual income (%)							
Number of rice	1.8	1.5	1.2	1.8	1.7	1.6	3.94***
varieties cultivated	(0.7)	(0.7)	(0.5)	(0.9)	(0.6)	(0.7)	
Cultivates more	68.4	56.3	35.0	56.9	60.8	57.7	
than 1 rice variety							
(% of yes)							

Table 4: Importance of rice in farmers' households

Figures in brackets (.) indicate the deviation from the mean of the variable measured.

***, **, and * indicate statistically significant at 1%, 5%, and 10% respectively

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

4.1.3. Rice production and post - harvesting practices

After harvesting, part of the paddy rice produced undergoes processing in terms of milling treatment towards the production of white rice (the rice ready to cook). The milling treatments followed by the producers in Togo range from traditional to improved methods. Though traditional milling methods are more accessible and popular among farmers, the quality of final product is very low compared to rice milled through improved methods. Adoption of improved processing methods largely depends on farmers' financial strength, their knowledge of the technology and the access to such facilities.

Husking is one of the major milling operations in rice post-harvesting systems practiced by the farmers in Togo. This consists of the removal of outer, thin coat viz., husk from the rice and could be done either manually, using pestle and mortar or using a husker machine. As discussed above, using mechanical means of removing husk ensures good quality rice as well as higher output from milling compared to manual means. However, farmer access to husker machine is very limited in many parts of Togo especially in the rural areas. The table 5 presents the management of the rice production and the post-harvest strategies used by rice farmers in Togo. The results in the table 5 show that nearly 58 % of the sampled households had access to husker machine. Especially 97 % of farmers in *Maritimes* and 63 % in *Plateaux* regions used

husker machine for rice milling. This percentage is the lowest in *Kara* region where only 6% of rice producers used husker machine. This is probably an indication that farmers in urban areas have more access to improved production technology than farmers in rural areas.

Variables	Regions						
	Maritimes	Plateau	Centrale	Kara	Savanes	Total	
Number of observations	78	32	40	50	50	250	
Husking method (%)							
Using Pestle and mortar	2.9	37.5	51.3	40.8	94.1	42.3	
Husker	97.1	62.5	7.7	40.8	5.9	47.3	
Both	0.0	0.0	41.0	18.4	0.0	10.4	
Rice parboiling or Not? (% of	0.0	3.1	100	38.0	29.8	30.0	
households who responded							
"Yes")							
Received government assistance	62.8	62.5	0.0	67.4	8.2	43.3	
in rice commercialization or							
Not? (% of households who							
responded "Yes")							
Average share of rice production	78.4	67.5	61.1	68.5	47.8	67.0	
sold in the market (%)							

Table 5: Rice production and post production strategies

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

Another major operation in rice post-harvesting system is parboiling. Rice parboiling¹ is defined as an operation that basically consists in pre-cooking of paddy by steaming (Houssou et Amoussou, 2004). According to table 5, very few Togolese rice farmers parboil their rice before milling and those who do so only use traditional techniques. Our results indicate that less than 30% of the sample farmers parboiled their rice. This percentage is the lowest in *Maritimes* and *Plateaux* regions where as low as 3 % only parboiled their rice. This can be explained by the fact that in *Maritimes* and *Plateaux* regions where milling machines seem to be more accessible to rice producers, the need for parboiling the rice before milling is not as high as in regions where they have very limited access to modern milling equipment. This may also be due to the fact that consumers in urban regions such as *Maritimes* and *Plateaux* regions have access a

¹ Though not mandatory, rice parboiling enables advantageous physico-chemical and organoleptic modifications at the nutritional, economic and practical levels (Houssou, 2003; FAO, 1997; Gariboldi, 1986)

large variety of imported rice and therefore the demand for parboil rice is not as strong as in rural regions.

Rice producers in Togo usually market their produce through local marketing channels. On an average 66 % of the rice produced has been marketed by the farmers in the whole sample. Of this, farmers from *Maritimes* region marketed 78 % of their produce. In all the other regions nearly or more than half of their rice produced is sold in the market. In our econometric analysis we will examine what factors significantly affect the quantity of rice sold to the market by farmers.

In most of the cases, government intervention programs help to commercialize rice production system. The government intervention includes credit provision to rice growers, linking them to nearby markets and in some cases they purchase directly from the rice producers. In our survey, more than 40 % of the respondents were benefited by one or other government intervention programs that targeted rice commercialization (table 5). The rice producers in *Maritimes* and *Kara* received highest attention from these government programs compared to other regions in Togo. Indeed, *Lome*, the capitale of Togo, is in the *Maritimes* region and is the region where the port is located. Therefore commercial activities in that region are considerably influenced by the government since they are the driving force of the economy of the country.

4.1.4. Demographic characteristics of sample traders

As a part of our survey, we included traders to study their interactions with the farmers and how they influence farmer's participation in the markets. Traders are the major agents in a rice marketing channel and their performance and behavior have important implications towards market development and farmers' market participation decisions as well.

The table 6 summarizes the socio economic and demographic characteristics of sampled traders. As indicated in the table, almost 60% of the traders are female. And the distribution per region also shows that most of the sample trader respondents are female. This confirms the fact that most of rice post-production activities such as harvesting to marketing operations are mostly carried out by women. In most of the

cases, women are the consumption decision makers and they sell in small quantities from time to time, to earn money to buy other consumption goods.

Variables		Regions					
	Maritimes	Plateau	Centrale	Kara	Savanes	Total	F test
Number of observations	56	30	40	38	30	194	
Numbers of prefectures	3	2	3	3	3	14	
Gender Male Female	32.1% 67.9%	83.3% 16.7%	30.0% 70.0%	29.0% 71.1%	36.7% 63.3%	39.7% 60.3%	
Mean age	43.0 (11.5)	40.3 (8.7)	37.7 (11.4)	38.2 (7.3)	38.6 (8.5)	39.9 (10.1)	2.3*
Years of experience	10.1 (7.3)	8.3 (6.6)	10.1 (7.1)	10.10 (6.7)	8.9 (8.2)	9.6 (7.2)	0.5
Received some formal education or Not? (% of traders who responded yes)	82.1	73.3	65	81.6	36.7	70.1	
Main activity General	75.9%	100%	59.0%	50.0%	40.0%	65.3%	
Commerce of food product	14.8%	-	41.0%	42.1%	43.3%	27.9%	
exclusively Agriculture	1.9%	-	-	2.6%	13.3%	3.2%	
Rice is main food product sold or Not? (% of traders who responded yes)	51.8	44.8	79.5	76.3	79.3	65.5	
Importance of products other than rice in the daily revenue from commerce of food product (%)	30.0	0.0	36.2	19.6	22.4	23.4	

Table 6 : Socio economic characteristics of sample traders

Figures in brackets (.) indicate the deviation from the mean of the variable measured. ***, **, and * indicate statistically significant at 1%, 5%, and 10% respectively

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010).

The traders are relatively young with an overall mean age of 40 years (table 6), and most of the traders were in an age range of 40 to 50 in the sample. The F-test is significant at 10% indicating that there are differences amongst regions in terms of the age of traders, ranging from about 38 years old on average in *Centrale* region to 43 years old on average in *Maritimes*. In spite of their young age, the average number of years of experience in trading activities is about 10 years. Women traders usually start their trading operation much younger in their age, helping out their mothers to start with and become full-time, professional traders when they become adults. The F-test shows no significant differences amongst regions in terms of traders experience in rice commercialization.

High education rate (70.10%) observed amongst traders overall and across all regions is also a confirmation of the relatively high education rate observed in Togo. A lot of educated women are then involved in trade activities in Togo. This is a positive factor that can improve traders' access to market information and help them take advantage of it. Only in *Savanes* region, the education rate of sample traders was less than 50%. This can be explained by the fact that *Savanes* is the region where literacy and education rate are still low and where poverty is the most prevalent in Togo (MERF-TOGO, 2009).

Rice traders in Togo also tend to diversity their activities across a set of possibilities. The descriptive statistics presented in table 6 indicate that 65% of our sample traders have general commerce as main activity. They tend to commercialize large varieties of commodities not limited to foods products. Amongst them, only 28% are found to commercialize food products exclusively. Nevertheless rice takes on a great importance in the trade activities of our sample traders. More than 65% of rice traders in our sample indicated that rice is the main food product that they sell. And more than 75% of the gross revenue they get from commerce of food products is earned through selling rice whether it is local, imported, or both. Besides, about 3% of the respondent traders have agriculture as main activity. Those are classified as farmers-traders who commercialize mostly their own agricultural produce. Being a farmer-trader improves access to market information and therefore has important implication for market participation decision.

4.1.5. Traders' resource ownership and access to credit

Traders in Togo have very limited access to resources and assets. The Togolese rice traders' resource ownership and access to credit is presented in table 7 below.

According to the table only 42 % of the traders surveyed in our sample have owned their shop or stores to conduct the trading activity and this percentage is highest among the traders located in the markets of *Plateaux* region.

Variables Regions							
	Maritimes	Plateau	Centrale	Kara	Savanes	Total	
Number of observations	56	30	40	38	30	194	
Source of initial capital Self-funded Financial aid	82.4% 9.8% 2.00/	63.3% 30.0%	83.3% 2.8%	78.4% 8.1%	90% 3.3%	79.9% 10.3%	
Store ownership Owned Rented	3.9% 41.8% 58.2%	56.7% 43.3%	47.5% 52.5%	27.3% 72.7%	40% 60%	8.2%42.6%57.5%	
Ownership of personal transportation or Not? (% of traders who responded yes)	26.8	40	2.5	13.9%	33.3	22.4	
Ownership of personal storage place or Not? (% of traders who responded yes)	63.6	46.4	37.5	15.2	40	43.0	
Sale on credit or Not? (% 0f traders who responded yes)	67.9	65.2	65	75	80	70.3	

Fable 7: Traders	' resource ownersh	ip and access to credit
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Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010).

Transportation costs usually contribute a great deal to the marketing costs of many developing countries, such as Togo, where roads and other infrastructures of transport that facilitate access to market are poorly developed (World Bank, 2008). In such conditions, ownership of any means of personal transportation such as a four-wheeler, a truck, a bike considerably reduces the transportation costs for traders. But the results in table 7 indicate that only 22.40% of our sample traders owned some means of personal transportation. And among those who owned some means of personal transportation, more than 60% used it for the transportation of rice. This suggests that

improved access to personal means of transportation would reduce the transaction costs in the rice marketing chain in Togo, which will eventually reduce market margins and may be increase farmers' participation to the market. In the same line, the ownership of the storage place in the market is an important for traders since it also helps reduce marketing costs. The results in table 7 indicate that only 45% of the sample traders owned a personal storage place. The rest of them are using rented storage place which also add up further to the marketing costs for the traders and farmers.

Access and availability of timely credit is another major factor that determines the strength of the commercial activity taken by the traders in these markets. From our study results, it was evident that the traders have very limited options or access to credit. They basically finance their activities either through self-funds, financial aid (from NGOs, government or sometimes political parties), or through credit from informal sector (such as cooperatives especially in rural areas) or formal finance institutions (banks). But access to credit is very limited. Informal system charges too high interest rates and the conditions bounded to the allocation of formal credit exclude or discourage traders. Those conditions include collateral requirements, complication in the process, short duration for repayment, etc. The survey results indicate that amongst those who asked for credit the last 2 years, 47.83% obtained it. But due to the conditions cited above, less than 20% of the sample traders have asked for credit. And because of this limited access to credit, the greatest part of the initial capital of traders is self-funded. As indicated in table 7 almost 80% of the sample traders' initial capital was self funded and only 8.15% come through credit.

Most of the descriptive statistics presented above, affect somehow the performance of the rice market and also the market participation behavior of rice producers in Togo. In the following section, we present the results of the analysis of the determinants of market participation and marketed surplus by rice farmers in Togo where we show how some of the descriptive statistics presented above affect the market behavior of Togolese rice farmers.

4.2. FACTORS AFFECTING RICE QUANTITIES SUPPLIED IN TOGOLESE MARKETS

4.2.1. Paddy rice production and marketed surplus in Togo

Table 8 presents Togolese farmers' paddy production and marketed surplus in 2009. On an average, rice farmers in Togo produced around 2.9 tons of paddy rice in 2009. The F-test indicates that there is significant difference amongst regions about the average quantity of rice produced by the household. As stated in chapter 3, rice production is likely to have a positive effect on marketed surplus so that regions with higher rice production per household are expected to have higher marketed surplus. According to table 8, rice production is the highest in *Maritimes* region where each farmer of our sample produced on average 5.29 tons of paddy rice in 2009. Notice that the average rice cultivated area overall in Togo was around 1 hectare in 2009, and in *Maritimes* region it was 1.5 hectare. This is very likely to influence positively farmers' market participation behavior and induce higher market participation rate and higher marketed surplus in the *Maritime* region compared to the other regions.

It could be seen in table 8 that more than 75 % of the farmers who produced rice participated in markets. This market participation rate found in Togo seems high compared to the evidence shown in the literature from other parts of Africa on some other food crops. For example, only 26% of the households were found to participate to the maize market in Kenya (Alene et al., 2008); and 52.58% participate in the banana market in Congo (Ouma et al., 2010). The relatively high participation rate noticed here may translate the importance of rice and the high demand for rice in Togo. There are differences amongst traders in the market participation rate. Market participation rate observed in the regions Centrale and Savanes are 30% and 64% respectively which is closer to the rate usually observed in the literature. The highest percentage of farmer' market participation were found in Kara (94 %); followed by Plateaux and Maritimes regions (about 90 % each). Those regions have the highest average rice production per household. Also, as stated in the descriptive analysis, farmers benefit the most from government intervention for rice commercialization in Maritimes and Kara regions compared to other regions. This may explain why those regions have the highest market participation rates. None of the sample farmers in centrale region had benefited from government programs for the commercialization of rice and this translates into a very low market participation rate in the region.

Variables	Regions						
	Maritimes	Plateau	Centrale	Kara	Savanes	Total	F test
Number of	78	32	40	50	50	250	
observations							
Paddy Rice	5.4	1.6	1.2	2.1	1.9	2.9	10.59***
Production in 2009	(5.8)	(1.0)	(1.0)	(2.5)	(4.7)	(4.3)	
(t)							
Rice cultivated area	1.5	0.5	0.6	0.7	1.0	1.0	5.72***
in 2009 (ha)	(1.6)	(0.3)	(0.4)	(0.5)	(2.2)	(1.4)	
Market participation	89.7	90.6	30.0	94.0	64.0	76.0	
(% of yes)							
Mean marketed	4.4	1.3	0.2	1.6	0.6	2.0	18.26***
surplus (t)	(5.2)	(1.0)	(0.6)	(2.0)	(1.3)	(3.5)	

Table 8: Paddy rice production and marketed surplus in 2009

Figures in brackets (.) indicate the deviation from the mean of the variable measured.

***, **, and * indicate statistically significant at 1%, 5%, and 10% respectively

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

The quantity of rice supplied to the market by rice farmers in Togo is also summarized in table 8 which indicates that about 2.02 tons of paddy rice was sold on average by rice producer in Togo in 2009 with the majority of the rice producers lying between 0 and 2 tons rice production interval. The F-test shows significant differences between regions in terms of market participation. Again, *Centrale* region where rice production level per household is the lowest has the lowest average marketed surplus whereas *Maritimes* and *Kara* have the highest marketed surplus. This confirms the importance of rice production for marketed surplus.

4.2.2. Determinants of rice marketed surplus

As discussed in the previous section, almost 75 % of the rice farmers in Togo make their decision to participate in the rice markets to dispose their surplus generated. Once they make their decision to participate in the market, they also make their decision on the quantity of rice to be sold based on the surplus generated. The surplus here refers to what is left after allocating for their food consumption, wages and loan payment (in kind), and was directly measured by asking farmers how much of their rice production was sold in the market in 2009. These decisions are recursive (refer chapter 3 for conceptual model) and could be estimated econometrically using discrete choice models. As mentioned in chapter 3 we estimated the determinants of marketed surplus using both Tobit and Heckman two-stage selection model and we then compare the results from the two models for consistency and robustness check.

In the following sections, the results of Tobit regressions and Heckman two-stage model presented and the results from those regressions are compared and discussed with relevance to the stated hypotheses in chapter 3.

4.2.2.1. Tobit regression results

Table 9 presents the results of the Tobit regression model, which analyzes the determinants of rice marketed surplus by farmers in Togo. Out of the 13 variables used in the model, 8 variables were found to significantly affect rice farmers' marketed surplus behavior. Most of the household characteristics notably schooling, gender, age of the household head, and the size of the household were found to significantly affect rice farmers' marketed surplus in Togo. Other variables such as the quantity of paddy rice produced by the household along with their interactions with social net work such a membership to a farmers association also affected the amount of rice supplied i.e, marketed surplus of the household. We also found the marketed surplus varied across farmers located in different regions. For instance farmers located in other regions. This might be due to agro ecological conditions or infrastructure available in those regions.

In the following lines we discuss how each of the variables significantly affects marketed surplus in the Tobit regression model.

Household characteristics

One of the household characteristics that relates **education** of the household head to their market participation is negative but significant, i.e, the more educated households were less likely to participate in the markets to sell their surplus. This counterintuitive result further contradicts our hypothesized, positive and a significant relationship between educated households and their market participation rate and other studies related. (Holloway et al., (2004) who used a Tobit model to analyze milk market participation in the Ethiopian Highlands found that the likelihood of market participation by more educated households were significantly higher than illiterate farmers. The negative sign observed for the education variable here may suggest that the existence and awareness regarding the existing of market imperfection in the rice markets in Togo further prevented them to participate in these markets. In other words the more educated household heads who are rational in their choices, will choose not to participate in these markets as the opportunity cost of participation is substantial in many instances.

Description	Coefficient	Standard	P value
		Error	
Household characteristics			
Schooling (yes=1 No=0)	- 1.73	0.57	0.003***
Gender (Male=1 Female=0)	2.57	0.88	0.004***
Age (years)	- 0.06	0.02	0.015**
Size of the family	0.34	0.09	0.000***
Share of rice in household total income (%)	0.01	0.01	0.344
Market related characteristics			
Paddy Production (tones)	0.64	0.04	0.000***
Is the producer a farmer-trader?	- 0.19	0.70	0.780
(yes=1 No=0)			
Price of paddy in the prefecture in 2009	0.04	0.04	0.254
(FCFA)			
Social network			
Membership to a farmer association? (yes=1	- 1.44	0.62	0.023**
No=0)			
Location effects			
Savanes (yes=1 No=0)	0.77	0.98	0.430
Kara (yes=1 No=0)	2.72	1.05	0.011**
Plateaux (yes=1 No=0)	-9.91		
Maritimes (yes=1 No=0)	3.19	1.33	0.018**
constant	- 10.41	6.17	0.095*

Table 9: Results of the Tobit estimates of determinants of marketed surplus

Figures in brackets (.) indicate the deviation from the mean of the variable measured.

***, **, and * indicate statistically significant at 1%, 5%, and 10% respectively

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

Gender of the household head is shown to be a significant determinant of marketed surplus. The coefficient for this variable is positive and significant at 1% level of confidence, indicating that male-headed households are more likely to participate in markets and dispose the surplus for cash compared to female-headed households. Indeed, most of female headed households are single or widowed women who take care of their family alone. In such conditions, their main production objective is oriented towards subsistence farming rather than commercial one. The surplus generated out of women headed households are also low which prevents them not to participate in these markets. Women in our sampled households also considered rice

as a subsistence crop and not for commercial purposes compared to other crops in the region.

Age of the household head is significant (at 5%) but negatively correlated with farmers' market participation, indicating older farmers are less likely to participate in rice markets. As farmers grew older they face several constraints ranging from access to market - transporting their produce, also not able to collect market related information from various sources, thus ended up being a subsistence producer. This confirms the results of Alene et al. (2008) who found that market participation declines with age and explained this by the increased risk aversion and reluctance of older farmers to adopt new and eventually more productive innovations.

Size of the household is positively and significantly correlated with rice marketed surplus at 1% level of confidence. Consistent to the empirical findings of Alene et al. (2008) and Ouma et al.(2010), our empirical results also suggest a significant relationship between the size of the household and their participation in the markets. The results confirm that larger sized households are likely to supply higher quantity of rice to the market than smaller households. This can be explained by the fact that larger households have more family labor that can help both in the production and marketing related activities.

Market related variables

Consistent with the economic theory (Chinn, 1976; Upender, 1990), our empirical results indicate an existence of a more significant and a positive effect of the **quantity of rice produced** in an household which in turn results in higher marketable surplus. In other words, the households who produced larger quantities of rice or with more rice production (output) always had more quantities of rice to dispose in the market, i.e., our results suggest that a 1 kg increase in rice production in an household resulted in about 0.64 kg of increase in the quantity of rice supplied in the market. This result supports the policy interventions that are directed toward improving productivity of rice by providing farmers with improved rice varieties as well as better production and processing technologies.

The coefficient of the variable **price** is not significant but positive in our empirical estimates. The positive sign in the Tobit regression model is consistent with the

findings of Strauss (1984) and Ouma, Jagwe et al. (2010). The fact that the price of paddy is not a significant determinant of rice marketed surplus in Togo also explains the fact that rice farmers in Togo currently do not respond to price signals (De Janvry, Fafchamps and Sadoulet, 1991). This means that price policies cannot be used as effective policy instruments to stimulate farmer's market participation in Togo because price signals are not transmitted well to rice farmer's in Togo. Policy interventions are usually directed toward changing constraints and incentives so that it becomes rational for people to behave the way that is desired by the government. For example exchange rate, fiscal, monetary, and trade policy are meant to encourage (or discourage) production, import, export, and innovation. The channel through which these signals are meant to operate is the market and inefficiency in the market results in bad transmission of those signals (Barrett, 2009). This result confirms then the existence of serious market imperfections that need to be investigated and addressed for the development of rice sector in Togo.

➢ Social network

Membership to a farmers' association is an important measure of the farmer's involvement in a social network. The result of our Tobit regressions shows that this variable affects farmer's marketed surplus significantly, but in a negative way, i.e., farmers who were a part of a social net work did not generate enough surplus to participate in the markets. The farmers association in Togo often provides information regarding market opportunities for various crops in the concerned region, thus allowing them make choices either to market or not based on profitability decisions. Therefore, members of farmers' associations don't rely solely on rice to satisfy their cash requirements. They have some other cash crops that provide them with some cash and thus may affect negatively their propensity to market their rice production. Ouma et al.(2010) found that membership to a farmer group has also a negative but non-significant effect on market sales.

<u>Geographical location</u>

As far as the location dummies are concerned, positive and statistically significant coefficient at 5% level of confidence were obtained for *Kara* and *Maritimes* regions. This indicates that farmers in those regions supply higher quantity of rice to the market. As mentioned in the descriptive statistics, *Kara* and *Maritimes* are the regions

where the highest proportion of producers benefits from government intervention or assistance such as credit provision, market connection, amongst others. Also the *Maritimes* region is characterized by better infrastructure and relatively high economic activity. This is therefore a confirmation that government interventions are very useful and important for the development of agricultural market, and suggest that government interventions be more fairly directed toward the different regions in terms of rice marketing in Togo.

As mentioned in chapter 3, the main problem about the Tobit model is that it implies that market participation decision and marketed surplus levels are influenced by the same variables and in the same way. But in reality a variable that affect participation decision may or may not have similar effect on the volume of rice supplied to the market. This problem can be fixed by using the Heckman two-stage selection model which estimates the market participation decision and market supply decision separately. The following sub-section presents the results of the Heckman two-stage selection model.

4.2.2.2. Heckman two-stage results

The first step of the Heckman model uses a Probit regression model to estimate the factors determining farmers' decision to participate to the market. From this first step, we calculate the Inverse Mills Ratio (IMR) that is used to correct for selectivity bias in the second step of the Heckman two-stage selection model. The second step is an OLS regression model that incorporates the IMR as independent variable to control for the selectivity bias.

The results of the Probit estimates of determinants of market participation are summarized in the table 10. The dependant variable is market participation which is a dummy variable indicating whether or not the farmer sold a positive quantity of rice from his production in 2009. This table indicates that 5 out of the 13 variables used in the probit model significantly affect farmers' probability to participate in the market. These are household characteristics such as education, age of the household head and size of the household; market related variable namely price of the paddy rice in the prefecture, and the location dummy for *Kara* region.

Household characteristics

As indicated in Table 10, **schooling** or education of the household head showed a negative and statistically significant coefficient (at 5% level) in the Probit regression. As in the Tobit regression, this counter-intuitive result further contradicts our hypothesized, positive and a significant relationship between educated households and their market participation rate and other studies related. Since this variable captures the access to information of the farmers, which is supposed to reduce fixed transaction costs and improve likelihood of participation to the market (Ouma *et al.*, 2010; Azam, Imai and Gaiha, 2012), the negative sign observed translates the existence and awareness regarding the existing of market imperfection in the rice markets in Togo, which further reduces their likelihood to participate to the market.

Description	Coefficient	Standard	P value
		Error	
Household characteristics			
Schooling (yes=1 No=0)	- 0.90	0.43	0.034**
Gender (Male=1 Female=0)	0.56	0.59	0.343
Age (years)	- 0.04	0.02	0.010***
Size of the family	0.13	0.07	0.050**
Share of rice in household total income (%)	0.01	0.01	0.460
Market related characteristics			
Paddy Production (tones)	0.04	0.04	0.377
Is the producer a farmer-trader?	0.28	0.57	0.617
(yes=1 No=0)			
Price of paddy in the prefecture in 2009	0.10	0.05	0.059*
(FCFA)			
Social network			
Membership to a farmer association? (yes=1	- 0.57	0.39	0.144
No=0)			
Location effects			
Savanes (yes=1 No=0)	0.38	0.58	0.508
Kara (yes=1 No=0)	1.67	0.68	0.014**
Plateaux (yes=1 No=0)	-2.81	316.51	0.993
Maritimes (yes=1 No=0)	0.52	1.05	0.621
constant	- 14.32	7.93	0.071*

Figures in brackets (.) indicate the deviation from the mean of the variable measured.

***, **, and * indicate statistically significant at 1%, 5%, and 10% respectively

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)
The **Age of the household** head is significant at 1% and negatively correlated with farmers' probability to participate to the market. Consistently with the findings of Alene et al. (2008) and our Tobit regression model, this result indicates that as farmers get older they are less likely to participate to the market. This can be explained by the fact that there are several constraints bounded to market participation, such as limited access to market, transportation constraints, lack of market information, so that older producers who are usually more risk averse prefer to be subsistence producers.

Size of the household is also positively and significantly correlated with market participation at 5% level of confidence. This is consistent with the findings of Alene et al. (2008) and Ouma et al.(2010), as well as the Tobit result presented above, confirming that larger households have more family labor that are helpful not only in the production of rice, but also in the commercialization or rice so that transaction costs appear to be reduced for larger household which encourage them to participate into the market. However, this is not sufficient to encourage farmers to increase household size. The extent to which this positive effect holds need to be clearly investigated in order to draw some accurate policy recommendations.

Market related variables

Price of paddy in the prefecture is significant at 10% confidence level only and affects rice farmers' decision to participate to the market positively. This means that the higher the price of paddy rice in the prefecture, the more likely are farmers to bring their rice production to the market. This is consistent with the prediction and empirical findings of Strauss (1984), Singh et al. (1986), and Ouma et al. (2010). However the coefficient is significant just at 10%, which indicates that Togolese rice producers are not very responsive to price signals.

Social network

The result of the probit model in table 10 indicates that the variable **membership to a farmer association** does not significantly affect rice farmers' likelihood to participate to the market but has a negative coefficient. This contradicts our prediction and the empirical findings of Ouma et al. (2010) who found a positive and statistically significant relationship between a member of a household belonging to a farmer group

and the likelihood of that household participating in banana markets as a seller in Central Africa.

Geographical location

The only location dummy that significantly affects farmers' decision to participate to the market is *Kara*, which is one of the regions where the highest proportion of rice farmers receives government help for the commercialization of their rice production. This dummy variable was also significant in the Tobit regression model, confirming the result of Ouma et al. (2010) that differences between region in terms of agro ecological conditions, infrastructures or access to policy intervention, affect farmers' market participation choices.

In the second stage of the Heckman model, we estimate the determinants of households' marketed surplus controlling for selection bias. Table 11 summarizes the results of the second stage estimation of the Heckman Selection Model. It uses an OLS regression model that includes the IMR calculated from the Probit model as independent variable. The results indicate that only two variables namely size of the family and quantity of paddy rice produced the household significantly affect quantity of rice supplied to the market once the household has decided to participate into the market. We notice that the coefficient of the IMR is not significant which means that the use of a normal OLS regression model to estimate the determinant of marketed surplus in the second stage of the Heckman selection model would not have yielded bias estimates here. It was not necessary to control for selection bias by introducing the IMR in the second step of the Heckman selection model. However even if the common significant variables showed consistent effect on marketed surplus, the results of the Heckman two stage model show that the decision to participate to the market and the rice sales to the market are not affected by the same variables in the same way as assumed by the Tobit regression.

Description	Coefficient	Standard	P value
		Error	
Household characteristics			
Schooling (yes=1 No=0)	0.09	0.50	0.864
Gender (Male=1 Female=0)	0.35	0.63	0.583
Age (years)	- 0.02	0.02	0.334
Size of the family	0.22	0.07	0.003***
Share of rice in household total income (%)	0.002	0.01	0.756
.			
Market related characteristics	0.50	0.02	0.000****
Paddy Production (tones)	0.79	0.03	0.000***
Is the producer a farmer-trader?	0.43	0.45	0.331
(yes=1 No=0)			
Price of paddy in the prefecture in 2009	0.03	0.03	0.220
(FCFA)			
Social network			
Membership to a farmer association? (yes=1	- 0.63	0.54	0.244
No=0)			
Location effects			
Savanes (yes=1 No=0)	- 0.34	0.77	0.659
Kara (yes=1 No=0)	0.19	0.98	0.844
Plateaux (yes=1 No=0)			
Maritimes (yes=1 No=0)	0.84	1.01	0.408
Inverse Mill Ratio (IMR)	0.24	1.03	0.813
constant	- 6.82	4.75	0.151

Table 11: Results of the OLS estimates of determinants of marketed surplus

Figures in brackets (.) indicate the deviation from the mean of the variable measured.

***, **, and * indicate statistically significant at 1%, 5%, and 10% respectively Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

In the following lines, we briefly discuss the variables that significantly affect rice marketed surplus in Togo.

The main variable that determines the size of rice marketed surplus of Togolese rice producers is the Production of paddy rice. The OLS results indicate that this variable is positively and significantly related with quantity of rice supplied at 1% level of confidence. The coefficient observed for this variable implies that once farmers have decided to participate in the market, a 1kg increase in rice production is followed by about 0.8kg increase in the quantity of rice supplied to the market. This confirms the above Tobit result and supports the policies interventions that are directed toward

improving productivity of rice though better production and processing technologies and improved rice varieties.

Size of the household is also positively and significantly correlated with rice marketed surplus at 1% level of confidence. Consistent to our Tobit results and to the empirical findings of Alene et al. (2008) and Ouma et al.(2010), this result also suggests a significantly positive relationship between the size of the household and their marketed surplus. As explained before, larger households have more family labor that can help both in the production and marketing related activities.

In general, most of the above econometric results namely the non responsiveness of farmers to price signals and the counter-intuitive negative effects of schooling and membership to a farmer association on rice farmers' market participation decision, translate important market imperfections that raise transaction costs in the rice marketing chain in Togo. In the following section, we will analyze the structure and performance of the rice marketing chain in order to find eventually the sources of such transaction costs that may hinder farmers' market participation.

4.3. STRUCTURE AND PERFORMANCE OF RICE MARKETS

4.3.1. Roles and linkages of actors in the existing rice marketing system

In this section, we discuss the role and linkages of chain actors that undertake various marketing functions in the rice marketing system in Togo. Market participants in the study area included farmers, millers, part-time village and urban traders who were engaged in three major activities such as collection of grains, performing wholesale operations (either full-time or part-time) and retailing businesses. We call collectors the people who collect grain from farmers at the village level. Also sometimes, we distinguish semi-wholesale traders from wholesale traders based on the volume of rice traded. Semi-wholesale act mainly as intermediary between wholesale traders and retailers, and they usually trade less important quantities of rice than wholesale traders. Most of the traders performed multiple activities in the rice value chain.

In our sample, 39 % represented whole sale traders (full and part-time); 57 % of them were retailers and 4 % of the traders were involved in collection of rice from the villages (table 12). In all the regions, except *Maritimes*, the number of retailers appears to be higher than the number of wholesaler traders and collection agents. In

the *Maritimes* region, the markets were mainly dominated by whole sale traders and retailers only. The whole sale traders in the *Maritimes* also performed the collection operations, and they procured directly from the rice producers. Also, the greater part of the rice sales by the *Maritimes* agents is imported rice and they sourced directly from the firms involved without any intermediary involvement. The rice markets in *Plateaux* and *Savanes* regions also did not have collectors and were dominated by whole sale traders and retailers. This was partly to avoid higher transaction costs by involving intermediaries – viz., collection agents in the market chain.

Variables		Regions					
	Maritime	Plateau	Centrale	Kara	Savanes	Total	
Number of observations	56	30	40	38	30	194	
Wholesaler and semi	69.7	26.7	35.0	34.2	6.7	39.2	
wholesaler							
Retailer	30.4	73.3	62.5	47.4	93.3	56.7	
Collector	0.0	0.0	2.5	18.4	0.0	4.1	

Table 12: Traders' categories of the rice marketing chain in Togo

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010).

4.3.2. Marketing channels

Rice marketing channel can be defined as the sequence of intermediaries through which rice passes from the point of production to the end consumer. The analysis of marketing channels is intended to provide a systematic overview of the path followed by rice from their origin (producer or import-export Company) to the final destination (consumer). The most important channels in the transfer of rice in Togo are listed below.

The channels followed by imported rice include only the import export company, the wholesaler, the retailer and the final consumer; whereas the channels followed by the local rice may include much more intermediaries such as producer, village paddy collector and urban assembler in addition to the intermediaries cited for the imported rice channels. Obviously, the imported rice channels are much simpler than those followed by local rice in Togo. Layers of intermediaries in the local rice chain implies that transaction costs are raised which eventually increases marketing costs and

margins, which hampers competitiveness of the rice locally produced in Togo compared to the imported rice (World Bank, 2008).

4.3.3. Structure of rice market

In this section we first present a description of the quantity of rice traded in each of the 5 regions of Togo before presenting the results of the concentration ratio calculations.

4.3.3.1. Volume of rice sold in Togo markets

In Togo, rice is sold all the year round. However volumes of rice traded vary largely across period, across regions, and across traders within regions as well. According to the quantity traded per week, the year is divided into high, medium and low activity periods. The average quantity traded in a week during each period was calculated by the quantity of rice traded across 5 regions per week in Togo. The results are summarized in table 13 below.

Types of rice		Regions				
	Maritimes	Plateau	Centrale	Kara	Savanes	Total
local rice	182	3.8	67.2	288.1	119.0	141.8
	(696.4)	(6.3)	(111.9)	(429.6)	(208.1)	(437.6)
Imported rice	5168.9	100.8	211.4	1333.2	49.4	1820.0
	(17690.4)	(145.8)	(433.1)	(5642.6)	(110.3)	(10005.7)
Both	5350.76	104.5611	278.6583	1621.32	168.5	1961.8
	(18139.2)	(145.1)	(479.4)	(5596.8)	(209.6)	(10237)
Rank	1	5	3	2	4	

Table 13: Quantity of rice sold on average per week

Figures in brackets (.) indicate the deviation from the mean of the variable measured.

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010).

According to the table 13, each trader in our sample sells an average of 1962 Kg of rice every week, including about 1820Kg of imported rice and 141.79Kg of local rice, indicating the dominance of imported over local or domestic rice sales by traders in the market. The superiority of imported vs local rice can also be observed within regions with a higher quantity of imported rice than local rice traded in every region except in *Savaness*. These results confirm the low competitiveness of local rice versus

imported rice in Togo in terms of quality/price ratio. At the same price, imported rice usually satisfies more consumers' preferences than local rice. Consumers find that local rice is of a lower quality and often prefer to purchase imported rice (Tabone, Koffi-Tessio and Diagne, 2010). That is one of the reason why it is important to analyze the consumers' preferences, as well as the characteristics of rice for which consumers are ready to pay a premium, in order to improve local rice accordingly.

The *Maritimes* region dominates the overall rice sales across all the regions with more than 5300 kg of rice being sold every week. This quantity includes only 182Kg of local rice, representing 3.40% of the average quantity sold. In addition to the reason provided above for the superiority of imported rice over local rice, the geographical location of the Maritimes region (near to the ocean) make it the first region where the majority of rice import companies are settled. Therefore Maritimes region receive some extremely huge quantities of imported rice and sell it to the people from everywhere in the country. This makes the region the top region where the highest quantities of rice are traded weekly. The Savanes region is the only one where higher quantities of local than imported rice are traded. Traders from Savanes region trade on average 169Kg of rice weekly, including 119Kg (70.41%) of local rice. As mentioned in section 1, Savanes regions is the poorest in Togo (MERF-TOGO, 2009) and this result may indicate that local rice is more demanded amongst the poorest communities than the wealthiest in Togo. This is an indication that the rice locally produced in Togo is of less desirable quality than imported rice. This result justifies research works that aim at developing improved rice varieties that satisfy consumers' preferences and also have good productivity.

In addition to analyzing the rice sold in different markets in Togo we further describe the structure of the rice markets in Togo by computing concentration ratio, i.e., to measure competitive these rice markets in Togo. The results of such analyses are discussed in the section below.

4.3.3.2. Concentration ratio

Our results indicate that the amount of rice traded varied considerably from region to region. The analysis of market concentration was carried for each of 5 regions of Togo, and the findings are summarized in table 14. In general we found that the rice markets in Togo are highly concentrated. In all the regions the CR4 is more than 50%

except in the *Savanes* region where it is 44.55%. This can be an indication of oligopoly behavior in the rice market system in Togo because in almost all regions, the results mean that the 4 biggest rice traders in the region control more than 50% of the total volume of rice traded weekly. The highest concentration ratio is observed in the *Maritimes* region where the CR4 is 82.11%. From the 56 traders interviewed in the *Maritimes* region, 3 are very big rice traders who sell over 60000kg of imported rice on average every week.

Moreover, given the quantity of each type of rice (local vs. imported) that is sold by traders every week; we calculated CR4 for local and imported rice separately. The results presented in table 14 indicate that in all regions except *Plateaux*, CR4 is higher for imported rice than for local rice. This implies that there is more oligopoly behavior in the imported rice market than in the local rice market. Therefore, increasing the competitiveness of local rice relatively to imported rice market power in the rice market chain and improve its performance.

Types of rice		Regions				
	Maritimes	Plateau	Centrale	Kara	Savanes	
Local rice	78.3%	60.9%	49.2%	46.5%	55.2%	
Imported rice	83.3%	54.4%	61.6%	81.4%	78.7%	
Total	82.1%	52.4%	51.7%	67.6%	44.5%	

Table 14: Concentration ratio CR4 in each region of Togo

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

Overall, the results of the market concentration analysis show that the top 4 traders handle a great part of the rice market, indicating some oligopoly in rice market in all regions of Togo. This suggests that there is market imperfection because a few traders have monopolized the rice market. Also the results reveal higher market power in the imported rice market than in the local rice market. As postulated in the SCP paradigm, the existence of market power is expected to reduce the efficiency of the rice market thus resulting in higher market margins.

In the following section we present the results of the local rice market margins analysis conducted across the 5 regions of Togo. We start with the gross margins, and

then we present transportation costs since we don't have information about other types of marketing costs. Finally we present the partially net margins (gross minus transportation costs only).

4.3.4. Marketing costs and margins

4.3.4.1. Market margins

Table 15 summarizes the gross margins obtained by the actors in the local rice value chain across the 5 regional markets in Togo. Prices are expressed in FCFA², the local currency in Togo.

Regions	Average	Processing	Average	Average	Gross	Gross
	paddy rice	cost	break-even	retail unit	Margin	Margin
	unit price		white rice	price	(FCFA)	%
	(FCFA/kg)		unit price	(FCFA/kg)		
			(FCFA/kg)			
Maritimes	160.2	17.3	253.5	427.8	174.2	40.7
Plateaux	170	24.9	278.4	525	246.6	46.9
Central	140.1	21	230.2	375	144.8	38.6
Kara	161.4	50.5	302.7	423.1	120.4	28.5
Savanes	155.6	22,7	254.7	330.8	76.0	22.9
TOGO	157.6	23,9	259.3	393.5	134.2	34,1

Table 15: Total Gross Marketing Margins per region in Togo

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

The calculations are made using the information from 3 different data sources. The average price of paddy rice in each region was calculated directly from the data collected from the farmer producers at the time of survey. It is the unit price reported by farmers, averaged across farmers in each region for their paddy rice. As indicated in the table 15, the average price of paddy rice overall in Togo is 157.57 FCFA per Kg. The processing cost was derived from the responses of the processors and denotes the mean of the milling costs for each region. Then, using the formula suggested by FAO, and assuming conversion rate is 70% in all regions, we get the average breakeven price per Kg for white rice. This is the price at which the farmer would sell the

white rice if he or she processes the rice by themselves to reduce the processing costs. The mean breakeven price per kilogram of white rice in Togo is around 348 FCFA.

We further derived local rice retail prices from the information obtained through retailer interviews and averaged across all the regions, the unit price paid by consumers to the retailers. The average retail price paid by consumers in Togo across all the regions was about 394 FCFA. The difference between retail price and break even white rice unit price gives marketing margin.

Our findings indicated that average marketing margin in Togo is 134 FCFA, which represents 35% of the final retail price. Any policy that aims at reducing this percentage could further help towards reduced prices paid by the consumers, in turn would increase the farmer's share in the consumer price. Of the regions, the highest marketing margins were realized in *Maritimes* and *Plateaux* regions where total gross margins were found to be 40.73% and 46.97% respectively. Those regions have better endowments in terms of transport and communication infrastructure facilities compared to other regions. Therefore this result suggest that large market margins in the rice sector are more the result of considerable profit made by larger trader who are holding an oligopoly power than to the marketing costs.

We analyze below transportation costs to check how they influence market margins in the rice markets in Togo.

4.3.4.2. Marketing costs

The reduction of marketing margin requires the understanding of the composition of those margins. The relevant question is whether high gross margins are due to too high marketing costs or too much profit made by traders. According to Holtzman (1986), it is recommended to examine just gross market margin rather than going through the complicated process of collecting detailed information on each cost in order to estimate net margins. Indeed, as mentioned in chapter 2, high gross margins in developing countries often reflect high marketing costs due to inadequacies in transportation and communication infrastructure. However, high gross margins may also indicate too high profit margins. And since we found the presence of oligopoly power in the rice marketing chain in Togo, there are reasons to believe that market power also plays a substantial role in the gross market margins. Therefore it is worthy to examine to the extent possible, the costs in the local rice marketing chain in Togo.

As mentioned above we could only calculate transportation costs due to data limitation. But in general transportation costs are one of the most important components in the marketing costs or transaction costs in most of the developing countries. Lack of or inadequate infrastructure in terms of transport and roads are the major factors that results in high transportation costs, driving up transaction costs (World Bank, 2008). The analysis of transportation cost in the marketing of locally produced rice in Togo is presented in Table 16.

Regions	Transportation costs (FCFA per Kg)	
Maritimes	11.9	
Plateaux	3.3	
Central	9.0	
Kara	6.4	
Savanes	5.5	
TOGO	7.6	

Table 16: Transportation costs per region in Togo

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

The results indicate that the transportation costs accounts for about 7.59 FCFA per Kg of rice, representing less than 2% of the retail price overall in Togo. These transportation costs are relatively low compared to the 11% estimated in the maize market in Ghana in 2006 (World Bank, 2008). The highest transportation cost was observed in the *Maritimes* region where it was 11.89 FCFA that is only 2.73% of the local rice retail price in the same region. This may probably be due to the fact that in many traders transport the rice on non motorized means of transportation such as bicycles and they don't incur much costs for gas.

4.3.4.3. Gross margins excluding transportation costs

We present here the partially net margins calculated for each of the 5 regions of Togo. Those partial net margins are the difference between Gross margins presented in table 15 and transportation costs presented in table 16. The results are indicated in the following table 17.

Regions	Net margins (FCFA per Kg)	Net margins (%)
Maritimes	162.4	38.0
Plateaux	242.8	46.2
Central	135.9	36.2
Kara	114.0	27.0
Savanes	70.5	21.3
TOGO	126.6	32.2

Table 17: Net margins in the rice marketing system per region in Togo

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010)

As indicated in the table 17, net margins are not very different from gross margins since transportation costs were not very high. Net margins were found to be 126.60 FCFA representing about 32% of retail price of locally produced rice in Togo. This result adds to the results of concentration ratio analysis presented above which indicated the presence of oligopoly power in the rice marketing chain, and suggest that some dominant traders are making too large profit. However, the partial net margins alone do not necessarily indicate that rice traders are making too large profit. There are certainly some others costs such as storage, loss, and fees included in those margins. For example, the fact that very few traders own the place where they trade their rice is likely to make storage fees very high. And during the transportation and storage of rice there may be considerable losses of grains that add to the marketing costs.

Apparently, gross market margins in the rice marketing chain in Togo are the result of both large profit made by dominant traders enjoying an oligopoly power, and the other forces that drive up transaction costs in the marketing chain.

In order to better understand the source of the market imperfections identified from the previous results in the rice marketing chain in Togo, we will describe in the following section the constraints faced by rice farmers and traders in Togo.

4.4. MAJOR PRODUCTION AND MARKETING CONSTRAINTS

There are a number of highlighted constraints that hamper further development of the rice sector in Togo. The following production and marketing problems were the main issues indicated by various respondents.

4.4.1. Production and marketing problems of farmers

The results of the analysis of rice producer constraints are presented in Tables 18 and 19 Table 18 summarizes the rankings obtained from the farmers based on their perceptions regarding the major problems faced in the rice production. Of the 13 constraints listed, majority of the farmers ranked weed management and access to credit as the primary issues in rice production in Togo. Farmers in Togo are generally poor with very limited financial resources to purchase any external agricultural inputs towards rice cultivation. Lack of or limited access and availability of financial resources often affects the crop management practices and resulting in low productivity levels, which eventually affect market participation decision as shown in section 2 of this chapter.

N= 253	weighted Frequency	Percentage	Rank
Weeds	589	16.4	1
Problem of credit	442	12.3	2
Birds attack	414	11.5	3
Problem of fertilizers	386	10.8	4
Problem of workforce	332	9.3	5
Rodent attack	224	6.2	6
Problem related to water	177	4.9	7
Diseases	166	4.6	8
Access to land	154	4.3	9
Problem of equipment / infrastructure	149	4.2	10
Management of the water on the plots	118	3.3	11
Climate changes	113	3.2	12
Accessibility of good quality seeds	110	3.1	13

Table 18: Major problems in rice production

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010).

Apart from problems in rice production, rice producers in Togo also face some problems related to rice post-harvest strategies. The ranking of the main post-harvest problems faced by farmers is presented in Table 19. As indicated in the table, problems of marketing of the produce and loss of grains are the 1st and 2nd main post-harvest problems faced by farmers. Farmers have trouble finding a market for their

rice produce because the rice locally produced is not very competitive versus the imported rice. Also there is a lot of grain losses after harvest due to several factors mostly related to storage, transportation, processing, and packaging conditions. Transportation systems are very weak, road are not of very good qualities and very few producers own a mean of transportation themselves. Moreover, access to husking machine is not guaranteed to the majority of farmers and when they do have access to it the machine is rarely of a very good quality, leading to considerable losses in the quality of local rice. All these factors obviously raise transaction of participating to the rice market and hamper Togolese rice farmers' participation to the market.

N= 253	weighted	Percentage	Rank
	Frequency	of responses	
Problem related to the marketing of produce	781	25.6	1
Loss of grain after harvest	668	21.9	2
Problem of transport after harvest	649	21.3	3
Difficult access to husking machine	340	11.2	4
Quality problem of grain bound to the processing			
equipment	251	8.2	5
Problems related to the extension services	175	5.7	6
Quality problem of grain bound to the nature of the			
paddy rice	116	3.8	7

Table 19: Major problems in rice post-harvest activities

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010).

4.4.2. Marketing constraints of traders

The table 20 presents the ranking of the major problems faced by rice traders in Togo. Lack of consistent demand and financial capital for further business expansion were the foremost problems faced by the rice traders in Togolese markets. There are numerous traders who are involved in rice marketing and related activities in Togolese markets, with very few government restrictions on regulating the trade, especially the inflow of imported rice in to these markets. With few or no restrictions on rice trading activities, the supply often exceeds the demand and traders mostly ended up not selling the entire stock. The market clearing price is below the break-even price that

traders may charge to sell their rice without incurring considerable loss. Therefore some traders are obliged to enter some special arrangement with buyers, such as selling their product on credit and get the payment at a determined future date, with eventually some risk of default by the buyer. The survey results indicate that more than 70% of the rice traders in Togo sell their rice on credit (See table 7). In addition, traders lack capital to finance the expansion of their activity. They also lack key productive assets such as means of transportation that could help them reduce transaction costs and make more profit from their activity.

N= 253	weighted Frequency	Percentage	Rank
Difficulty of finding buyers	521	16.6	1
Problem of capital	307	9.8	2
Lack of personal means of transportation	263	8.4	3
Irregularity in the supply in rice	249	8.0	4
High cost of transport	245	7.9	5
Lack of store of storage	242	7.7	6
Difficulties in the acquisition of the rice	241	7.7	7
Unfair competition	224	7.1	8
Unavailable carriers in time	217	6.9	9
Difficult access to procurement contracts	152	4.9	10
Difficult access to credit	125	4.0	11

Table 20: Major commercialization problems

Source: Calculated by Author from the Consumer Preferences Survey (AfricaRice Center, 2010).

CHAPTER V: SUMMARY AND CONCLUSION

5.1. OVERVIEW

This study uses data from consumer preference survey initiated by AfricaRice center and conducted in 2010 by the Togolese Institute for Agricultural Research in the 5 regions of Togo namely: *Maritimes, Kara, Centrale, Plateaux, Savanes*, to analyze the **Efficiency and Performance of Rice Marketing Systems in Togo**. In particular a separable agricultural household model is constructed to model Togolese rice producers' decision to participate to the market, and their marketed surplus once the market participation decision is made. Then concentration ratio and market margins indices are calculated to describe the structure and performance of the Togolese rice market. Finally a descriptive analysis of the main constraints faced by rice producers and traders in Togo is presented.

The first objective of the study is to estimate the main factors that determine Togolese farmers' participation to the rice market. This decision has been modeled within an Agricultural Household Framework, following Singh et al (1986). Given that market exists both for rice and the inputs used for rice production (notably labor) in the study area, a separable household model is used (De Janvry, Fafchamps and Sadoulet, 1991). The empirical estimation of the model uses both Tobit and Heckman two-stage selection model and the results are compared. The particularity of the Heckman two Stage approach is that farmers market participation decision is separated in two steps: first the farmers decision whether to get involved in the market or not is estimated using a Probit regression model; once the farmer has decided to participate into the market, the quantity of rice supplied to the market is estimated by an OLS regression and controlling for the selection bias. Overall the estimation results show similar findings from both estimation approaches. The main factors that affect significantly Togolese rice farmers' market behavior are household characteristics notably schooling, gender, age of the household head, and the size of the household; quantity of paddy rice produced by the household; and the social network of the household head captured by his membership to a farmers' association. Also, some location effects exist for the regions Kara and Maritimes which appear to have positively significant effect on rice farmers' market participation. Both the Tobit and the Heckman models shows that an increase in the rice output is followed by an increase in the quantity of rice supplied to the market. This result supports the policies interventions that are directed toward improving productivity of rice though better production and processing technologies and improved rice varieties. However, the results indicate that marketed surplus is not very responsive to price signals in Togo. Price of paddy was found to be significant only for the probability to participate to the market and at 10% confidence level only. This indicates the presence of some imperfections in the togolese rice market, and this gives little policy instruments to governments for policy interventions. Also, non responsiveness of farmers to price signal makes it difficult for them to respond to the preferences of consumer for rice attributes that are transmitted through price signals, which dampens competitiveness of local rice versus imported rice.

The second objective of the study is to analyze the structure and performance of the rice marketing system in Togo, in order to better understand the market conditions that rice producers are facing. This may help explain or find the source of imperfections that leads to non responsiveness to price signals and help design appropriate policies to increase market participation and marketed surplus. Concentration ratio and market margins are then calculated for each of the five regions of Togo. The results of the market concentration analysis shows that the four-firm concentration ratio CR4 in the five regions lie between 44.5% in Savanes regions to 82.1% in the Maritimes region. This indicates that the top 4 traders in the Togolese rice market handle a large part of the rice market, indicating some oligopoly behavior in rice market in all 5 regions of Togo. The market power in the rice marketing chain translates into relatively high market margins. The results of the market margin analysis show that average gross marketing margin is 134 FCFA, which represents about 35% of the final retail price of rice. Transportation costs are fairly low in the rice marketing sector in Togo. They account for about 7.59 FCFA per Kg of rice, representing less than 2% of the retail price overall in Togo so that net margins (gross minus transportation costs) were still relatively high. The oligopoly situation that was concluded from our analysis of market concentration suggests that traders might be making too high profit. However some other types of marketing costs such as storage fees and losses during transportation and storage may contribute as well to increasing marketing costs. Future research is needed to better understand the nature and size of all the costs involved in the marketing of rice in Togo.

Moreover, the analysis of the main constraints faced by farmers and traders in the rice sector in Togo which is the third objective of the study, reveals that weed management and access to credit are the primary issues in rice production in Togo. Also after the rice is harvested, farmers in Togo face problems of marketing of the produce and loss of grains. They have trouble finding a market for their rice produce because the rice locally produced is not very competitive versus the imported rice. Also loss of grains during transportation and storage increase considerably the transaction costs and eventually affect their market participation behavior. As far as rice traders are concerned they lack consistent demand and financial capital for further business expansion. They also incur considerable loss of grain during transportation and storage which has important implication for marketing costs and market margins.

In the following section we make some suggestions towards addressing the main issues pointed out by the results of this study in the Togolese rice marketing sector.

5.2. POLICY RECOMMENDATIONS

In conclusion, the rice marketing chain in Togo is not efficient and its performance is hindered by many factors that need to be addressed by the government in order to make effective the Togo National Rice Development Strategy (TOGO-NRDS) that aims at increasing the local rice production up to almost 140,000 tons of milled rice by 2018 in order to reduce imports of rice and increase food security in Togo. This study identifies specific interventions, initiatives and innovations that can improve rice market in Togo, to the mutual benefit of both producers and consumers. These actions include fundamentally reducing transaction costs and increasing rice production.

First, the results of our market participation imply that increasing rice production will have a positive impact on rice market participation and marketed surplus in Togo. Therefore government policies that are directed towards increasing rice production need to be sustained and improved. They need to focus more specifically on the problems of weed management and access to credit. Farmers need to be introduced to improved rice varieties and better production technologies, and they need to get access to credit in order to be able to afford the technologies that are costly. Also, a particular attention should be given to the post-harvest strategies. Considerable losses in quality and quantity of grains are incurred by farmers during the processing of the rice because they don't have access to the best processing technologies. This leads to weak

competitiveness of local rice versus imported rice which makes it difficult for some farmers to commercialize their rice production. The government and development institutions in Togo should work toward making improved processing equipments and technologies as available as possible to farmers in order to increase competitiveness of local rice versus imported rice.

Second, the results revealed that there are important imperfections that raise transaction costs and reduce the efficiency and performance of the rice marketing chain in Togo and hinder market participation. Government and development institutions in Togo should help lower the high transaction costs associated with rice marketing by improving rice farmers' access to market information and improving transport infrastructures such as roads in order to reduce losses during transportation. They should also address the problem of oligopoly power in the rice sector in order to reduce the profit made by dominant traders in the market and thus reduce market margins.

5.3. LIMITATIONS AND FUTURE RESEARCH

The main problem related to the present study is related to data limitations. Indeed the data used for the present study were originally collected for the purpose of consumer preference analysis and not market analysis. Therefore many variables essential for the analysis of the rice marketing chain are missing.

Specifically, in the analysis of the determinants of market participation, variables such as distance to the market, ownership of means of transportation, and other variables that capture variable and fixed transaction costs of participating in the market are not available. Therefore our conclusion that transaction costs affect market participation decision can only be partial. We cannot know exactly how each specific type of transaction costs influence market participation, which make it difficult to formulate accurate policy recommendations. Future research should be conducted that breaks down the different sources of transaction costs or at least distinguish between fixed and variables transaction costs as in Key, Sadoulet and Janvry (2000) and evaluate how each of them separately affect market participation decisions.

Also, due to data limitations, it was impossible to separate the different categories of traders in the analysis of market concentration. Even though in the study area, the

same person will combine many different roles at the same time in the rice marketing chain (wholesaler and retailer for example), the interpretation of CR4 would make more sense and would be more accurate if those different traders categories were separated. Future research should then take this into account prior to data collection so that the data can be collected accordingly.

In addition, for the analysis of rice market margins, data about marketing costs were not available except for transportation costs. This makes it impossible to identify the real source of high market margin in the rice value chain. Future research should include data about all possible sources of marketing costs to identify whether traders are making too large profit or marketing costs are too high. It will also be more interesting to collect price data at each level of the marketing chain in order to evaluate the distribution of the market margin across the marketing chain and identify which actors are making too high profits.

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APPENDIX: OVERVIEW OF TOGO

This section provides a general description of the study area where the research has been conducted. Further the demographic and socio-economic characteristics of the study area also have been discussed briefly. The data and information presented here has been collected from various secondary sources (public) such as the Ministry of the Environment and Forestry Ressources of Togo (MERF-TOGO, 2009), the United Nation Development Programme's annual report (UNDP, 2011), COUNTRYSTAT, and FAOSTAT.

Togo is situated on the coast of the Gulf of Guinea in West Africa. The country shares its borders with Burkina Faso, Benin and Ghana (see figure). Togo is divided into five (5) main administrative regions viz, *Maritimes, Plateauxx, Centrale, Kara* and *Savanes* with thirty (30) prefectures and four (4) sub-prefectures.

Togo is influenced by two large climate systems. One is the tropical Sudanian system in the north with a wet season running from May to October and a dry season from November to April. The average rainfall received during the wet and dry season annually ranges from 900 to 1100 mm with temperatures reaching as high as 28°C. The other climatic system that is prevalent in Togo, especially in the southern part of the country is the tropical Guinean system, also characterized by two dry seasons and two wet seasons of unequal duration with rainfall amount ranging from 1,000 and 1,600 mm/year with an average temperature of 27°C.

Demographic and economic characteristics

The Togolese population is currently estimated at 6,028,000 (FAOSTAT, 2012). The population has quadrupled since 1960s from around 1.414.720 inhabitants, with an increase in population density from 25 inhabitants / km² in 1960, to 97 inhabitants / km² in 2007. Nearly 50 % of the population comprises of females. More than 50 % of the population is engaged in agriculture and allied activities, thus emphasizing the role of agriculture in the overall economy. The economically active population is estimated around 40 % of the total population of the country (FAOSTAT, 2012). Togolese population is made up of a mix of major ethnic groups that includes Ewe, Mina, Kabye, Cotocoli and Moba.

Contrary to its nearby countries of Sub-Saharan Africa, Togo offers a better system of education to its citizens. According to the Unified Questionnaire on Basic Well-being Indicators (QUIBB, 2006), the net rate of schooling in the primary level is as high as 73 %.

Figure: Map of Togo and its 5 administrative regions







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Also, the literacy rate among the adults is estimated at 57 % with literacy rate among men more prominent (70 %) compared to women (44%) (MERF-TOGO, 2009).

Togo is the world's 10th poorest economy with a per capita GDP equivalent to US\$ 437 (I-PRSP, 2008). Nearly 62 % of the total population is poor, mostly living in rural areas (Lundstrom and Garrido, 2010). Also, in terms of Human Development Index (HDI), Togo lags far behind, by occupying the 162th place among 187 countries appraised in 2011 UN's National Human Development report (UNDP, 2011).

As in most in Sub Saharan Africa countries, Togo's economy depends on the primary sector viz., agriculture which represents approximately 40% of GDP and involves 70% of the active population (I-PRSP, 2008) (MERF-TOGO, 2009). Agriculture remains the major driver of growth with an average growth rate of 2.9 % per annum and accounting for 20 % of export value in the country (Badjare, 2008). Togolese agriculture is dominated mostly by growing food crops. The most cultivated crops are cereals (maize, rice, sorghum, millet), tubers (yam, potato, manioc) and leguminous (bean, peanuts) crops. Out of the 842 124 ha of agricultural land cultivated, 599 646 ha are occupied by cereals, 103 625 ha by tubers, and 138 853 ha by various others food crops (Badjare, 2008). Besides several species of tropical fruits are also grown extensively, that includes mainly mango, banana, lemon and pineapple crops. In addition, farmers also plant few cash crops, in particular plantation crops such as cocoa, coffee and cotton, which generates nearly 40 % of the export earnings. Of the cash crops, cotton is the most preferred and widely grown crop in Togo (DSID, 2005).