Journal of Development and Agricultural Economics Vol. 4(6), pp. 178-190, 26 March, 2012
Available online at http://www.academicjournals.org/JDAE
DOI: 10.5897/JDAE11.100
ISSN 2006- 9774 ©2012 Academic Journals

Full Length Research Paper

Public market information system and farmers food marketing decisions: Econometric evidence from Benin

Sylvain Kpenavoun Chogou* and Esaïe Gandonou

Faculty of Agriculture, University of Abomey-Calavi, Cotonou, Republic of Benin.

Accepted 12 March, 2012

To sell the surpluses of maize, the main staple in Benin, farmers could choose among three modes of transaction: they could sell under a contract with itinerant traders, or sell without a contract at the farm gate or on distant markets. It has been postulated that farmers will choose a profitable mode of transaction if they receive reliable market information on the prevailing market conditions. Using detailed farm household survey data from Benin, this paper applied the Nested Logit model to test this hypothesis. The results showed that farmers will opt to sell at the farm gate without a contract if they receive market information and use it to plan their market transactions. However, such a decision was not related to the reception of market information channeled through the government supported 'Market Information System' but rather to information obtained from the farmers' personal or professional networks.

Key words: Farmers, modes of transaction, liberalization, public market information system.

INTRODUCTION

Markets, formal and informal, are important for the poor who need them to sell their labor and products so as to finance their investments and to be insured against the risks involved. When the markets function well, they stimulate the growth and open up opportunities for the poor (World Bank, 2001). In particular, access to a well remunerated market is one of the most important factors influencing farm performance, especially, in developing countries. Improving smallholder farmers' market access can thus be an essential component of the strategy of rural poverty reduction. This is why the multilateral and national aid agencies and governments in developing countries are favorable to the reforms aiming at releasing market forces.

Since 1990, most reform efforts in sub-Saharan countries are targeted to agricultural market liberalization. Most of the governments have stopped intervening directly in the markets via marketing boards or parastatal organizations. Market Information Systems (MIS) thus, emerged as an accompanying measure of this reform. They were very much intended to correct the asymmetries created by economic liberalization, giving more bargaining power to farmers, creating a more transparent, open trading environment and fostering more efficient market systems for all stakeholders. Consistent studies on the ongoing listed benefits from MIS in the context of poor countries still remain scarce (Tollens, 2006). He showed, using simple examples, that there is a severe lack of empirical studies to answer key questions such as 'have poor farmers obtained better market access, following the implementation of MIS? or 'has the price discovery process by farmers been more efficient, following the introduction of MIS?'.

This paper relates to the general literature on the role of access to information in enhancing the participation of small-scale farmers to the market with the objective of reducing rural poverty in LDCs. Indeed, a striking feature of agriculture in poor countries is that the majority of food staple producers opt out of markets, even when price incentives are offered to them in order to break out from this 'perverse' optimal choice (Barrett, 2008). Since the

*Corresponding author. E-mail: kpenavoun@yahoo.fr, kpenavoun@gmail.com. Tel: (+229) 96372821.

pioneering works of de Janvry et al. (1991) and Goetz (1992), various conceptual and empirical works have been applied to analyze this problem inspired more or less by transaction-cost theories. They confirmed that subsistence agriculture trap in poor countries, is the result of high market entry costs, the most prominent being the cost of access to information. This is the main reason why the implementation of Public Market Information System (PMIS) is being encouraged. However, the literature also points out that to design a comprehensive policy package to eliminate the subsistence trap is problematic. Additional analysis is therefore useful.

The review of the literature indicates a gap which, if filled, could be a good starting point for improving the policy agenda. Indeed, until now, the smallholder market participation research agenda focuses mostly on the (discrete) decision to participate or not in the market as well as, the intensity of the participation. Detailed analysis on the "success stories" of those smallholder farmers who take the risk to participate into the market is still missing. What type of arrangements do they submit to when selling their surpluses (are these arrangements contractual or not; if not, do they sell at the farm gate or on distant markets?). How do they perceive the benefits from the available arrangements and what determines the decision to selecting a particular type of arrangement? By asking such questions, we obviously intend to apply insights from the New Institutional Economics to assess the patterns of smallholder market participation. In particular, we exploit the governance approach developed by Williamson (1991, 2002). In the Williamson's framework, the arrangements to which the different parties involved in the transaction over a good can submit are designated by the term modes or forms of governance. Market is one of these modes. But, the parties may also choose hierarchy or a hybrid form.

One of the main characteristic of markets is that they imply autonomous relations between the parties while hierarchies involve authority relations (cooperation). The hybrid form exploits the advantages of the two polar modes (market, hierarchy) although, it should not be viewed as loose amalgam of market and hierarchy but as a form that possesses its own disciplined rationale (Williamson, 1991). Williamson predicts that a particular mode is chosen always after comparison with alternative modes; in any case, it is the transaction cost economizing mode that is chosen and this choice is contextual. The regulatory framework, economic environment and the characteristics of the good under transaction, all, play a role in the selection of a particular mode of governance (hereafter, mode of transaction).

We exploit this framework to analyze the transactions for the major staple food crop in Benin (maize). It has been postulated that surplus farmers choose among several modes of transaction. With the availability of an institutional innovation such as a PMIS, the ranking of the modes of transactions may change; re-orienting farmers towards the mode which economizes transaction costs the most, that is, the transaction mode which they perceive as the most profitable.

The term 'profitable' needs further clarification. However, in transaction-cost theory, the absolute value of the market price is not the main indicator of profitability of a transaction, rather, it is the 'net' market price that is the focus; this is the price obtained after carefully deducting from the absolute value of the market price all transaction costs. Each farmer will certainly carefully do this estimation for the different modes of transaction he is confronted with and once this is done, he compares the 'net' prices across modes and selects the mode with the highest value[1]. According to North and Wallis (1994), transaction costs include the costs of land, labor, capital and entrepreneurial knowledge necessary to transfer property rights between individuals. Such costs are paid, for instance, for searching for suppliers or buyers, for negotiating, screening, measuring the attributes of goods or services being exchanged, transferring of goods or services (transporting, processing, packaging and securing title), for monitoring whether the terms and conditions agreed are fulfilled, for enforcing agreements (Smith et al., 1999). Obviously these are 'hard-to-measure' values, in particular, in the context of poor countries (de Janvry and Sadoulet, 2006). Therefore an explicit value for the 'net' market price per mode of transaction can hardly be estimated[2].

Nevertheless, one can use an indirect approach to get rid of this difficulty. In the views of policy-makers in Benin and other poor countries, PMIS can help to reduce most of the costs listed earlier while raising the absolute levels of the market price. Therefore, if we can establish if the availability of PMIS favors a particular mode of transaction, it can be postulated that the latter is the most 'profitable'. To do this a two-step strategy can be adopted. First, we can try to observe whether the farmer is aware of the market data provided through PMIS and has used them to search for buyers for her produce. At a second step, this information will be related to the variable showing the mode of transaction through which the farmer's agricultural produce has been sold. If a positive correlation is found for a particular mode of transaction, it can be inferred that the availability of PMIS has a positive contribution to market transparency, by re-orienting farmers towards a mode which, in the context of the study area, is the most 'profitable'.

In this article, we propose to investigate whether smallholder farmers have indeed added PMIS to their

[1]Alternatively, one may argue that farmers 'estimate' rather the ratio 'transaction costs to the absolute value of the market price' for the different modes of transaction, compare these ratios across modes and then select the mode with the lowest ratio.

[2]Most authors suggest not to use the market 'rates' to estimate these costs but rather to replace them by shadow (implicit) costs. However, most also recognize that this is often hard to apply (de Janvry and Sadoulet, 2006). Apart from this problem, some of these costs are hardly observable in rural areas of poor countries.

traditional sources of information on prices (and on other market conditions). If they do, then we want to test if using this new source of information is associated with the pattern of their participation in the market of a major staple food crop (maize) in Benin.

To test this framework, detailed farm household and market surveys have been carried out in important maize producing zones in Benin. During the survey, a variable was carefully observed that showed the different sources of market information from which market data have been collected by the surveyed farmer before he decided to select a mode of transaction in the particular survey year. We distinguished between two main sources of information: information provided by PMIS and by personal/professional networks. We used the variation across farm households for this variable as well as, variation in the patterns of modes of transaction to construct an econometric model which describes how a particular mode of transaction for maize is chosen in the study sample.

The results showed that farmers will sell at the farm gate without a contract if they receive information and use it to plan their market transactions. However, such a pattern of market participation was not found for farmers using market information provided by the government supported 'Market Information System' but rather for those who continued to use exclusively information collected through 'traditional' sources of information (that is, information obtained from farmers' personal or professional networks).

To the best of our knowledge, Fafchamps and Hill (2005) is the only attempt to date, to implement a systematic analysis of the farmers' choice of modes of transaction for the agricultural products in the context of LDCs. While Fafchamps and Hill focused on an export crop (cocoa), we choose to examine the case of a staple food crop (maize). We also extended the analysis to the use of private contracts (between itinerant traders and smallholder farmers) in the marketing of this crop.

AGRICULTURAL TRADE AND MARKET INFORMATION IN BENIN

In Benin, domestic agricultural trade is dominated by maize. The market share of this crop attained 40 to 50% (Minot et al., 2001). In normal years, the country is self-sufficient in maize. As until 1995, Benin has a surplus of maize of around 30,000 tons which are exchanged with neighboring countries (Niger, Burkina-Faso, Togo and Nigeria). The level of cultivation of maize between the South and the North differs because of variation in climatic conditions. Further, the motivation for cultivation varies between the two regions. In the South, which is mostly humid, maize is a staple food, grown by farmers primarily to meet subsistence goals; there are two harvests per year (small and long rainy seasons). The North is semi-arid and has only one harvest and maize is almost a cash crop.

The distribution of maize is regulated by a private market system which is integrated into a larger network of markets including markets in neighboring countries. Traders operate within a spatial network of both formal (periodic spot markets) and informal market places. Numerous petty traders and wholesalers are involved in the business but most handle relatively small volumes (1,000 kg per market day) and a few large wholesalers with substantial market power, are present (Lutz, 1994; Adégbidi et al., 2003).

The functioning of the maize market is well-documented (Lutz, 1994; Adégbidi et al., 2003; Galtier, 2002; Tassou, 2004; Ahohounkpanzon, 1992; Fafchamps and Gabre-Madhin, 2006). For most studies, the level of transparency is not high and there are often difficult impediments to free entrance. This is not only a consequence of physical barriers but there are also various institutional barriers to trade; for example, powerful "corporations" of traders may prohibit entrance in the markets in certain localities and farmers are the most targeted for exclusion.

Using trader survey data, Fafchamps and Gabre-Madhin (2006) found that search and transport costs are a considerable share of transaction costs in Benin (65%). They observed that this is the case mainly because, in Benin, frequent personal travel to market places by the traders themselves make up for the lack of efficient communication system to collect market data quickly. An estimated 250 trips by the trader to market places to do purchase or sales are found to be necessary, being an average per year in Benin. The study confirmed that traders are well aware of the problem of access to information and try several solutions. It revealed that, for instance, traders' associations are common in Benin (two thirds of surveyed traders are members of a traders' association) and their main objective of these associations is to facilitate access to market data for their members. An estimated 54% of traders reported that they are able to avoid personal travel to market places but still collect reliable data using such professional networks.

Using qualitative data, Lutz (1994) found that in Benin, not only traders but also farmers are well aware of the problems of access to information. He observed that to reduce them, they rely mainly on their personal networks (friends and relatives) which they use to obtain price quotes and other data on the market conditions. However, the study concluded that this is hardly helpful when farmers want to obtain market data from distant (urban) markets, although, it confirmed that such networks are effective in providing reliable information for local (nearby) markets.

Institutional innovations such as a Public Market Information System (PMIS) can strengthen the efforts of farmers to reduce the problem of access to market data.

The government of Benin has received grants from

Table 1. Sources of market information exploited by farmers (n=241).

Sources of market information	Percentage
Personal/professional networks	
Traders	93
Friends and relatives	80
Public market information system (PMIS)	
Monthly market bulletin ONASA	0
Community radio stations	43
National radio station	6
Message blackboards in market places	4
SMS service	0

Source: Farm household survey, 2006/2007.

various organizations (FAO and GTZ etc) since the early 1990's to set up this system as an accompanying measure of economic liberalization. Unfortunately, a comprehensive assessment of PMIS and how it relates to the patterns of smallholder farmers market participation, using micro data cannot be found in Benin. This research has been initiated to fill the gap.

MATERIALS AND METHODS

Survey and data

The data used in this paper was gotten from a survey carried out in the communes of Pobè and Kétou in the department of Plateau, the largest maize producing zone in Benin. Previous studies suggest that market entry barriers are erected against producers and the non-residents traders in this region (Lutz, 1994; Adégbidi et al., 2003).

A sample of 241 farm households was randomly selected among maize surplus producers. The characteristics of PMIS and detailed data on the characteristics of households and farms, sources of information on the market conditions, agricultural financing and market participation have been collected. Community-level data were also collected (identification of farmers' unions and analysis of their role in the cereal markets). In a second step, a sub-sample of 124 farm households was drawn to implement a closer follow-up over one year (October, 2006 to September, 2007) for each maize transaction carried out in that period. Each month enumerators visit the households to collect the data. In total, 323 transactions were observed, on average 3 transactions per household. For each of them farmers are asked to give a description of; 1) where the maize is sold, 2) whom to, 3) how much was sold, 4) at what price and lastly, the kinds of arrangements used and other aspects of transactions.

In this second round of survey, enumerators were instructed to observe closely and report carefully data on farmers' access to and use of market information in the survey year. We were able to collect these data using a series of questions like; 1) Did you search for market information when you were planning to sell your produce in this crop season? 2) If yes, could you tell us the sources of the market information you were able to collect? 3) Is the mode of transaction through which your produce was sold was selected based on the market data obtained? As said earlier, we organized several round of discussions with the famers on these questions in the survey year. In particular, we had extensive discussions with the surveyed farmers in order to establish if they are aware of PMIS and whether they use the market data from this source to select their modes of transaction.

We were aware that the three questions shown previously need to be dealt carefully with because this has important implications for our empirical (testing) strategy. Indeed, in this research we mainly wanted to establish if the use of information influences farmers' choice of modes of transaction. If one applies an econometric model to test this link while using survey data (rather than experimental data) the well-known problem of 'reverse causation' can hardly be avoided. However, if we combine the data reported by the famers for all the three questions shown previously, we can construct a variable for information that we expect that it could be 'exogenous' and, therefore, the problem of reverse causation will be reduced.

The data confirmed that the surveyed farmers are aware of the value of information. They all reported that they usually search for market information. An overwhelming majority (83%) of the surveyed farmers collect market data using two or three sources. A few (13%) use one source and the rest (4%) collect market data from four to six sources.

Table 1 show the main sources of information reported. Market information is received by farmers primarily from personal and professional networks. A significant number (80%) enter into contact with friends (other farmers) and relatives to obtain market information. They also use market quotes provided by traders (93% of the surveyed farmers), which is surprising since traders may have the incentives to give underestimated prices. A similar result is shown in Fafchamps and Gabre-Madhin (2006).

Table 1 show that farmers are less aware of PMIS. In Benin, PMIS is one of the most important activities of the national grain board, "Office of National Food Security Support (ONASA)" established in 1989 as an integral part of the economic liberalization policy reform in Benin. The targeted public for PMIS is government, traders, farmers, consumers. Government itself is a targeted client of PMIS because it uses the market data generated to implement planning and monitoring of food security in particular, for the early warning system. The latter is also a key mission of ONASA.

As components, PMIS includes the publication of food monthly market bulletins, the use of message blackboards showing the prices of major staple food crops, in particular, maize, in the market places across the country, broadcasting of prices and market information on radios (community radio stations, national radio station) and, recently, a Short Message Service (SMS) is also offered. The latter is expected to be very effective, since there is these days a boom in the telecommunication sector. However, Table 1 indicates that only a small proportion (less than 10%) of

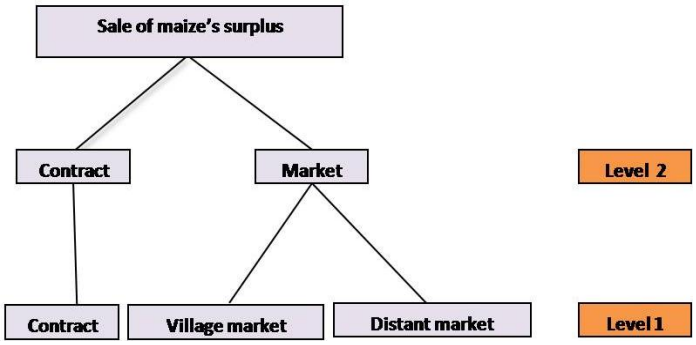

Figure 1. Nested structure for the sale of maize's surplus; source: farm household survey, 2006/2007.

farmers reported that they are used to collecting market data from most of the modes of information promoted. A relatively significant proportion (43%) is aware of only one component of PMIS which is the broadcast of prices and market information on community radio stations. Since every farmer in the survey sample owns a radio and the broadcast are done in local languages in hours of high audience, this result is not surprising.

The data on the reception of information in the survey year show that there are three categories of farmers. In the first category are those who collected market data exclusively through their personal/professional networks. They form 44.4% of the sample while the second category forms 36.3%. These are farmers who reported that they rely on PMIS (generally in addition to other sources).

The third category includes farmers who reported that they did not search for market information in this particular year before selecting their buyers (20.3%). It can be argued that this attitude is inconsistent because during the exploratory survey (first round survey) all these farmers reported that they know several (two to three) sources of information from which they usually collect market information. However, a closer look of the data indicates that all the farmers in this category reported that, in this particular year, they had an urgent need of cash. Therefore, investing in the search for market information becomes not their main objective but, rather, their objective is to find just a buyer, independently of the (price) conditions offered; the main decision factor becomes the capacity of the buyer to provide farmers with cash. Alternatively, we may say that this category of farmers set their own (reservation) price and, therefore, searching for market information becomes not necessarily a useful activity[3]. Of course, such an attitude is not hard to explain since extreme poverty is widespread in rural areas of Benin. As will be seen later, we have tried to control our empirical model for this particular attitude in the systematic analysis proposed in the next sections. Three modes of transactions have been observed namely; contract with itinerant t traders, selling without contract on the village market and selling without contract on distant markets. Distant market is meant to indicate the closest urban market. For the three modes of transaction observed in the survey area, the percentages are; 35% for the mode 'contract with itinerant traders', 45% for 'selling without contract on the village market' and 20% for 'selling without contract on a distant market'.

The contract system has several interesting features. First, contracts are oral. Secondly, the data showed that a farmer who is contacted by a trader always delivers, at harvest, all his maize surpluses to this trader. In other words, contractual terms are respected in the study area; enforcement problems are very limited. Thirdly, 'contracts' are accompanied by an offer of credit by itinerant traders to farmers; the credit is, in general, provided before the harvest, often at the onset of the crop season. Fourthly, prices are negotiated at the time of collection of the produce by the trader and, for this, both partners can use information on the prevailing conditions in the markets in this period. Payments may take place immediately after the collection of the produce or a few months later; the payment is equal to the value of the sales minus the credit received by the farmer.

Fifth, contracts are valid only for one cropping season. In other words, farmers do not see themselves as bound to traders. Provided the market information they have collected and other conditions they can easily move to other modes of transaction in the next season. A similar type of contractual arrangement in found by Smith et al. (1999) using the survey data from Pakistan. Descriptive statistics of the farm and household characteristics as well as, additional transaction-specific variables collected are subsequently discussed.

Estimation approach

Specification of the nested logit

Farmers may choose among three modes of transaction: contract, village market and distant market. So, we have a case of discrete choice models in the context of random utility theory (Train, 2003). In such a situation, it is a Multinomial Logit Model (MNL) which is usually applied. But the MNL assumes proportional substitution patterns (Independence of Irrelevant Alternatives, IIA). To relax this strong assumption of the multinomial (or conditional) logit model, we have chosen to apply the Nested Logit model which has become an important tool for the empirical analysis of discrete outcomes (Heiss, 2002; Silberhorn et al., 2008). The Nested Logit model is the most often used hierarchical model in marketing (Suarez et al., 2004) and can be used for modeling in any situation where subsets of alternatives share unobservable utility components (Ben-Akiva and Lerman, 1985). Let us suppose that we gathered the choices set into ₋subsets ('nests'). In each group l, there are J_l possible choices. On the whole, the individual has $J = J_1 + J_2 + \cdots + J_L$ possible options. In our case, the number of nests is $L = 2$ (Figure 1). The group of the producers who has a contract with the traders has only one choice, therefore $J_1 = 1$. On the other hand, the producers with no contract have two choices: sell on the village market or on a distant market. So, $J_2 = 2$ and, consequently, the producer has the choice between three options $J = J_1 + J_2 = 1 + 2 = 3$. Denote the nest to which alternative $j = 1, 2, ..., J$ belongs as J_j: $J_j = J_l : j \in J_l, l = 1, 2, ..., L$. In order to develop an intuitive expression for the choice probabilities, it is useful to decompose them into two parts. The probability of individual i choosing alternative j $P\ y_i = j$, is equal to the product of the probability to choose some alternative in nest J_j, $P\ y_i \in J_j$, and the conditional probability to choose exactly alternative j given

[3]One of the referees has turned our attention to the issue of the reservation price. But, as he/she noted, this can be hard to deal with empirically. However, in future studies, data collection needs to be framed in a way that we can explicitly show the link between small-scale farmers' crop marketing strategies and their reservation price in LDCs.

some alternative in the same nest J_j is chosen $P\ y_i = j \mid y_i \in J_j$; that is:

$$P_j = P\ y = j\ = P\ y = j \mid y \in J_j\ \cdot P\ y \in J_j \qquad (1)$$

Where the individual subscript i is dropped from now on for the sake of a more concise notation.

In our example, the probability of choosing to sell on a distant market $P(y = distant\ market)$ is equal to the probability of choosing to sell on market $P\ y \in J_{market}$ times the conditional probability of choosing to sell on distant market given a mode of transaction "market" is chosen $P\{y = distant\ market \mid y \in J_{market}\}$. This decomposition follows the rules of conditional probability and is especially useful for thinking about the Nested Logit model.

There are two different specifications of the Nested Logit model with different outcomes (Heiss, 2002; Silberhorn et al., 2008): the Random Utility Maximization Nested Logit (RUMNL) model and the Non-Normalized Nested Logit (NNNL) model. If there are no generic coefficients in the model the NNNL and the RUMNL specification are equivalent (Heiss, 2002). But, if this condition is not met, the procedures for the implementation of these specifications are not exactly the same. In many publications, the specification used is not explicitly mentioned (Silberhorn et al., 2008) and this is a source of confusion[4]. It is therefore useful to add here, further clarification about the differences between these specifications.

The RUMNL conditional choice probability of choosing alternative j given some alternative in its nest is chosen is $P\ y = j \mid y \in J_j$, which corresponds to a simple Conditional Logit model for the choice between the alternatives in nest J_j. But the utilities are rescaled by the inverse of the parameter τ_j for this nest. The parameter τ_j is often called dissimilarity parameter because it is an inverse measure of the correlation of the error terms of all alternatives within this nest:

$$P\ y = j \mid y \in J_j\ = \frac{\exp\ V_j/\tau_j}{\sum_{k \in J_j} V_k/\tau_j} \qquad (2)$$

The log of the denominator of this expression (IV_l) is called inclusive value or inclusive utility in the nest l. It corresponds to the expected value of the utility individual i obtains from the alternatives in nest l :

$$IV_l = \ln \sum_{k \in J_j} V_k/\tau_j \qquad (3)$$

So, $$P\ y = j \mid y \in J_j\ = \frac{\exp\ \tau_j IV_j}{\sum_{l=1}^{L} \exp\ \tau_l IV_l} \qquad (4)$$

The marginal choice probability for alternative j which is the full information likelihood contribution is:

$$P\ y_i = j\ = P_j^{RUMNL} = \frac{\exp\ V_j/\tau_j}{\exp\ IV_j} \times \frac{\exp\ \tau_j IV_j}{\sum_{l=1}^{L} \exp\ \tau_l IV_l} \qquad (5)$$

If a nest contains only one alternative (as in our case), it is called a degenerate nest. The dissimilarity parameter of degenerate nests is not defined in the RUMNL model. Since the degenerate nest J_j only contains alternative j, its inclusive value simplifies to $IV_j = V_j/\tau_j$. The dissimilarity parameter τ_j cancels out of the choice probability. This is intuitive since the concept of dissimilarity does not make sense with only one alternative. In the NNNL model, however, the dissimilarity parameter of degenerate nests does not vanish from the choice probability and may be statistically identified. Without generic variables, the dissimilarity parameters are not jointly identified with the other parameters, so they can be constrained to any non-zero value. If at least one generic variable is included in the NNNL model, the IV parameter of degenerate nests may be identified along with the other model parameters. This identification comes from the restriction of equally scaled parameters β_j/τ_j across alternatives and nests, and the parameters only constitute this scaling. A conventional approach to restrict the IV parameter to be equal to unity does not result in a model that is consistent with the underlying RUM model.

The estimated coefficients from RUMNL model can be readily interpreted and simple tests like asymptotic t-tests directly test hypotheses of interest. This holds irrespective of the type of included explanatory variables and specified nesting structure. But, the estimated parameters from NNNL model may not be interpreted as the structural parameters of an underlying Random Utility Maximization model as many researchers tend to do (Heiss, 2002). If there are only alternative-specific coefficients in the model, the Nested Logit specification chosen can be accommodated merely by a nest-specific re-scaling of the estimated coefficients obtained from the NNNL software before interpretation. As soon as a generic coefficient enters the model, the NNNL model is not consistent with random utility theory without imposing restrictions on the scale parameters. But these restrictions on the parameters are often counterintuitive and undesired (Heiss, 2002). This is why it is important to run the RUMNL model.

Empirical model

Equations 6 to 8 illustrate the empirical specification that has been estimated. The explanatory variables are those that are usually suggested in the literature on the relationship between transaction costs and smallholder market participation in poor countries (Vakis et al., 2003). The following variables are included; expected sale (producer) price for maize, marketing costs, distance to the market, duration of a transaction, household head cereal trade experience

[4]Since it is possible to estimate the Random Utility Maximization Nested Logit (RUMNL) model with Stata 9 or Stata 10, we implement the preferred RUMNL model with the package nlogitrum in Stata 10.

(years), household head education, household size, commune of residence of the head household, size of farm, share of modern seeds in total production of maize (%) and a variable indicating whether information is received and used by farmers to select their mode of transaction and what are the sources of this information. The variable for the reception of market information has three categories: information through PMIS, information obtained from personal/professional networks and 'no information'. The latter category has been added because in the survey year, some farmers reported that they did not use any information as discussed earlier. This third category was therefore, created to control for this attitude. As it is usually done, dummies were created for each category and only the first two categories (information through PMIS and information through personal/professional networks) are included in the model.

The dependent variable is mode of transaction: sale under contract (contract, c), sale in the village market without contract (village market, v) and sale in the distant market without contract (distant market, m). Sale on the village market is the base category. The functions of utility V_j of the three alternatives are defined as follows:

$$V_v = \beta_{PE} \cdot PE_v + \beta_{CO} \cdot CO_v + \beta_{DI} \cdot DI_v + \beta_{DU} \cdot DU_v + \varepsilon_v \quad (6)$$

$$\begin{aligned} V_c = {} & \alpha_c + \beta_{PE} \cdot PE_c + \beta_{CO} \cdot CO_c + \beta_{DI} \cdot DI_c + \beta_{DU} \cdot DU_c \\ & + \lambda_{EXP} \cdot EXP_c + \lambda_{INST} \cdot INST_c + \lambda_T \cdot T_c + \lambda_{COM} \cdot COM_c \\ & + \lambda_{GP} \cdot GP_c + \lambda_{PM} \cdot PM_c + \lambda_{VAR} \cdot VAR_c + \lambda_{PMIS} \cdot PMIS_c \\ & + \lambda_{CPV} \cdot CPV_c + \varepsilon_c \end{aligned} \quad (7)$$

$$\begin{aligned} V_m = {} & \alpha_m + \beta_{PE} \cdot PE_m + \beta_{CO} \cdot CO_m + \beta_{DI} \cdot DI_m + \beta_{DU} \cdot DU_m \\ & + \lambda_{EXP} \cdot EXP_m + \lambda_{INST} \cdot INST_m + \lambda_T \cdot T_m + \lambda_{COM} \cdot COM_m \\ & + \lambda_{GP} \cdot GP_m + \lambda_{PM} \cdot PM_m + \lambda_{VAR} \cdot VAR_m + \lambda_{PMIS} \cdot PMIS_m \\ & + \lambda_{CPV} \cdot CPV_m + \varepsilon_m \end{aligned} \quad (8)$$

Where;
PE = Expected sale (producer) price for maize
CO = Marketing costs
DI = Distance to the market
DU = Duration of a transaction
EXP = Household head cereal trade experience (years)
INST = Household head level of education
T = Household size
COM = 1 if the residence of the household head is Pobe (regional fixed effects).
GP = 1 if the maize producer belongs to the category of large-scale farmers.
PM = 1 if the maize producer belongs to the category of medium-scale farmers.
VAR = Share of modern seeds of maize in total production (%)
PMIS = 1 if the farmer is aware of market data from the Public Market Information System (PMIS) and has used them to select the mode of transaction adopted in the survey year
CPV = 1 if the farmer has used market data obtained through personal/professional networks to select the transaction mode adopted in the survey year.

In the model, there are four alternative-specific variables: expected sale (producer) price for maize (PE), marketing costs paid for selling maize (CO), distance to market (DI) and duration of a transaction (DU). All these attributes of the modes of transaction are introduced into the model like generic variables taking into account the advantages related to that.

Variables like age of the household head and the quality of the road which connects to distant markets were also included in the regression in preliminary analyses. But they were not finally selected for various reasons, in particular, they were found to be strongly correlated with other variables of the model. For the variable 'age', we found that its coefficient is not significant and it is also strongly correlated with the variable household head cereal trade experience (years) whose coefficient is significant.

As the model is partially degenerated on the level of the contract, the IV parameter does not exist for RUMNL model. The IV parameter for market is within the unit interval and implies that this model is consistent with random utility maximization.

RESULTS AND DISCUSSION

Descriptive analysis

Table 2 shows preliminary descriptive data on the link between the use of PMIS, modes of transaction and producer price levels for maize. The comparison of the prices across modes of transaction show interesting results. In Table 2, expected prices and the prices received by the farmers are compared. The results for the 'net' prices received are the most interesting and we can use these prices as rough approximation of the level of 'profitability' of the modes of transaction. These prices are obtained after deducting from the absolute value of the (producer) prices received only the 'easy-to-measure' transaction costs. Here, we included mainly all the 'cash' costs paid by the farmers for transport, processing and packaging of the produce. The data showed that the 'net' price for the mode 'village market, without contract' is almost 25% higher than for other modes. The other modes yield almost the same 'net' prices. An analysis of the variance of the estimated 'net' price confirmed that the difference of the 'net' prices across modes is significant (F-value = 2.90, p-value = 0.0586). A plausible conclusion is that the mode 'village market, without contract' should be the most preferred. However, several categories of transaction costs are not accounted for to derive the 'net' prices shown in Table 2 because they are 'hard-to-observe' and/or 'hard-to-measure'. Hence, this conclusion is not necessarily straightforward. Apart from the prices, we also collected qualitative data on the farmers' preferences for the modes of transaction. The conclusion inferred based on the 'net' prices shown in Table 2 seems to be confirmed by these data. The majority of farmers who selected the mode 'contract with itinerant traders' (81%) reported that they are not satisfied with the conditions they have accepted for their transaction (namely, the price conditions). In contrast, the percentages are 46 and 44% for 'village market without contract' and 'distant market', respectively. This is a clear indication that selling under contract is viewed by farmers as the less profitable alternative. Nevertheless, the rest

Table 2. Descriptive statistics on the characteristics of maize sales and maize farmers (N =124).

Variable	Modes of transaction			All
	Contract	Village market	Distant market	
Percentage of farmers in each mode of transaction	34.7	45.1	20.2	100
Number of transactions = 1 (%)	23.4	12.1	6.4	41.9
Number of transactions = 2 (%)	5.7	12.1	3.2	21.0
Number of transactions ≥ 3 (%)	5.6	21.0	10.5	37.1
Market information from PMIS is used to select the modes of transaction (% of farmers)	12.1	17.7	6.5	36.3
Market information from personal/professional networks is used to select the modes of transaction (% of farmers)	8.9	24.2	11.3	44.4
No market information is used to select the modes of transaction (% of farmers)	13.7	3.2	2.4	19.3
Expected sale (producer) price for maize (FCFA/kg)	114.8	120.2	116.0	117.5
With PMIS	133.4	119.5	132.9	126.5
Without PMIS	104.8	120.6	108.0	112.3
Sale (producer) price received (FCFA/kg)	70.2	84.3	77.3	78.0
With PMIS	89.5	87.5	96.7	89.8
Without PMIS	59.8	82.3	68.2	71.3
Net sale (producer) price received (FCFA/kg)	66.3	82.3	66.7	73.6
With PMIS	88.1	86.0	88.6	86.7
Without PMIS	54.6	79.8	57.6	66.1
Marketing costs (FCFA/kg)	3.9	2.1	10.7	4.4
Transport costs (FCFA/kg)	0.9	0.3	5.6	1.6
Distance travelled (km)	4.2	2.3	11.4	4.8
Duration of a transaction (hours)	3.8	3.1	4.1	3.5
Age of farmer (number of years)	46.9	43.5	45.4	45.1
Number of wives =1 (%)	10.5	20.2	4.8	35.5
Number of wives = 2 (%)	16.9	19.4	12.9	49.2
Number of wives≥ 3 (%)	7.3	5.7	2.4	15.3
Household head cereal trade experience (years)	23.6	24.0	26.3	24.3
Household head level of education (years)	2.3	2.0	3.9	2.4
Household size (number of persons)	11.4	8.9	11.2	10.2
Farmers reside in Pobe (%)	7.3	28.2	7.3	42.7
Large-scale farmers (%)	24.2	7.3	9.7	41.1
Medium-scale farmers (%)	9.7	5.7	17.7	33.1
Small-scale farmers (%)	0.8	20.2	4.8	25.8
Opinion about entry barriers on distant markets (% of farmers)	21.0	14.5	3.2	38.7
Adopters of modern seeds of maize (%)	31.4	32.3	17.0	80.7
Share of modern seeds of maize in total production (%)	98.1	100.0	94.4	98.2

Source: Farm household survey, 2006/2007.

two modes may yield comparable levels of profitability according to the data on the farmers' perceptions. From the ongoing discussions, we expect that anything that improves the reliability of market information and their use by farmers for the purpose of crop marketing planning will induce, at least, a move from the mode ‘contract with itinerant traders’.

As can be seen in Table 2, a simple cross-tabulation indicates that the mode ‘village market, without contract’ is indeed often selected by farmers who reported that they have received market information and used it to plan maize marketing. Nevertheless, this association does not appear strong, in the case of PMIS in particular. It has been observed that a significant number of ‘informed’ farmers continue to select the mode ‘contract’ with percentages being 35 and 20% for PMIS and for ‘personal/professional networks’, respectively.

As previously stressed, some farmers did not search for any information in the survey year. Data in Table 2 indicated that almost all of them have selected the mode

'contract with itinerant traders' as one would expect. According to the data on the farmers' perceptions, all these farmers reported that they were facing urgent needs of 'cash' in the survey year. Hence, the main motivation of their choice was not the market (price) conditions, but how to quickly find a trader who can provide them with cash. Under such conditions, to move to the mode 'contract with itinerant traders' should be a consistent choice as this facilitates access to credit.

The cross-tabulations shown in Table 2 are not sufficient to infer conclusions about the association between reception of market information and modes of transaction. One needs to implement a systematic analysis. Table 2 presents also a descriptive data on the potential control variables to be included in such systematic analysis. Table 2 also presents an additional data to characterize the survey sample.

The average household size is 10 persons. An average year of schooling for the household head is limited (2.4). The highest level of schooling is found among farmers selling on distant markets (almost 4 years). Mean age of the household head is 45 years, and the number of years of experience in cereal trade is 24. Three categories of farmers have been formed based on the size of the total cultivated area; 1) large: ≥ 12 ha to 25%; (2) medium: 5 to 12 ha to 41%: (3) small: < 5 ha to 34%. More than 50% of large farmers sell under contract. Most of the small farmers (78%) are under the mode 'selling without contract on the village market.' Maize yield are 1724, 1426 and 1077 $kgha^{-1}$ for large, medium and small farmers respectively. Modern seeds of maize are adopted by 81% of the sample.

Econometric results

Table 3 presents the empirical results of the RUMNL and the Conditional Logit models. Both models seem to fit the data fairly well. However, because of the earlier conceptual discussions, only the results for the RUMNL model will be discussed.

In Table 3, three versions of the estimated RUMNL model are presented. The results for the third version (nested logit 3) are those that correspond to the empirical model represented by Equations 6 to 8. The other two versions (nested logits 1 and 2) are slightly modified versions of this model. In 'nested logit 1' we included only one variable for the reception of market information (INFO). This is a dummy which receives 1 if the farmer reported that he received market information (whatever the source) and used it to select the mode of transaction adopted and 0 otherwise. This model confirmed that a correlation does exist between the reception of market information (whatever the sources) and the modes of transactions. The association is stronger with the mode 'village market, without contract'.

In 'nested logit 2' we want to show if the reception of market information through PMIS makes a difference. Hence, we introduced only the dummy PMIS only with the value 1 for information through PMIS and 0 otherwise. This model contains no significant coefficients for the variable for the reception of information.

With the third version (nested logit 3) where the category 'no information' is controlled for, that is, when we introduced both the variables PMIS and CPV in the model, the association of information with the mode of transaction is recovered. The results of this model confirmed that it is a good idea to observe farmers closely and determine if they have actively searched for market information, or not, before selecting a mode of transaction. In case some farmers did no search, it is useful to control for this in any systematic analysis on the effects of market information, in the context of poor countries. In this research, we suggested a simplified procedure to implement this control. However, we are aware that a more elaborated strategy may be necessary[5].

In the following discussions, the analysis will focus on the results of model 3. In Table 4, the marginal effects of the explanatory variables are presented. From the results, it can be inferred that farmers will prefer the mode 'selling on the village or distant markets' if they are able to find market information before engaging in the market exchanges. However, such a decision may not be related to the reception of market information through the government supported 'Market Information System' but rather, it is induced by market information obtained through farmers' personal/professional networks.

Indeed, it has been found that the coefficient for PMIS is negative, as expected, but insignificant for the mode 'contract with itinerant traders'. In contrast, the coefficient of the variable for CPV is negative and significant for the mode 'contract with itinerant traders'. The negative sign of this coefficient probably say that farmers tend to avoid contractual arrangements with itinerant traders when personal/professional networks can be mobilized to supply reliable market information, rather, they prefer to use market (village market or distant market) for maize transaction. However, it may be useful to indicate that the model does not indicate clearly in this case what is the dominant mode of transaction between 'selling on the village market' or on a 'distant market'. This result does not invalidate the role of PMIS but rather it tends to reinforce the importance of this system. The message is that the government-supported MIS in Benin needs to be improved to be effective.

During the survey data, we also collected from the farmers' perceptions the reliability of the main sources of information identified. Table 5 presented the average ranks that the surveyed farmers have attributed to each

[5]Of course, why farmers who are well aware of the value of market information and agree that they can access this information, at least, through personal/professional networks will not do any search to plan crop marketing, is surprising as stressed before. To control for this may require to shift to a different analytical approach and also an improved dataset.

Table 3. Nested and conditional logit models for the choice of the modes of transaction for maize.

Variable	Nested logit 1	Nested logit 2	Nested logit 3	Conditionnal logit
Alternative-specific constants				
Contract	0.981 (-0.65)	-2.137 (-1.52)	-1.158 (-0.77)	-1.001 (-0.52)
Distant market	-1.170 (-0.83)	-0.421 (-0.33)	-0.742 (-0.58)	-1.946 (-1.24)
Alternative-specific variables				
PE	0.0002 (0.05)	-0.0002 (-0.14)	-0.0003 (-0.12)	0.0002 (0.03)
CO	-0.004 (-0.49)	-0.002 (-0.30)	-0.003 (-0.43)	-0.007 (-0.94)
DI	-0.0357 (-0.78)	-0.011 (-0.32)	-0.020(-0.55)	-0.064 (-1.80)
DU	0.017 (0.65)	0.005 (0.29)	0.009 (0.49)	0.031 (1.75)*
Individual-specific variables				
INFO *contract	-1.275** (-2.11)		-	-
INFO *distant market	0.175 (0.34)		-	-
PMIS *contract	-	0.393 (0.77)	-0.679 (-1.02)	-0.723 (-1.00)
PMIS *distant market	-	0.143 (0.31)	0.293 (0.49)	0.878 (0.91)
CPV *contract	-	-	-1.687 (-2.64)***	-1.780 (-2.35)**
CPV * distant market	-	-	0.0333 (0.14)	0.002 (0.00)
EXP *contract	-0.029 (-1.34)	-0.027 (-1.27)	-0.027 (-1.22)	-0.024 (-1.06)
EXP * distant market	0.01 (0.64)	0.005 (0.33)	0.008 (0.55)	0.019 (0.95)
INST*contract	-0.024 (-0.08)	-0.044 (-0.53)	-0.006 (-0.07)	-0.065 (-0.65)
INST* distant market	0.048 (0.76)	0.021 (0.32)	0.035 (0.57)	0.042(1.40)
T *contract	0.079 (1.58)	0.091 (1.29)	0.071 (1.48)	0.087 (1.65)*
T * distant market	0.041 (0.77)	0.013 (0.32)	0.021 (0.54)	0.067 (1.21)
COM *contract	-0.024 (-0.03)	-0.221 (-0.30)	-0.103 (-0.14)	-0.253 (-0.29)
COM * distant market	-0.124 (-0.21)	-011 (-0.07)	-0.058 (-0.18)	-0.625 (-0.80)
GP *contract	2.845 (2.94)***	2.958 (3.17)***	2.788 (2.91)***	3.102 (2.53)**
GP * distant market	0.683 (0.75)	0.231 (0.32)	0.399 (0.56)	1.161 (1.44)*
PM *contract	0.832 (1.01)	0.901 (1.10)	0.817 (0.98)	0.731 (0.70)
PM * distant market	-0.070 (-0.17)	-0.011 (-0.09)	-0.034 (-0.15)	-0.161 (-0.22)
VAR *contract	-0.082 (-0.10)	-0.118 (-0.14)	-0.075 (-0.09)	-0.159 (-0.19)
VAR * distant market	0.098 (0.22)	0.024 (0.18)	0.038 (0.16)	0.082 (0.10)
IV Parameters (inclusive value)				
Contract	-	-	_	_
Market	0.494 (0.77)	0.132 (0.32)	0.243 (0.54)	_
Model parameters adjustment				
Numbers of observations	372	372	372	372
Log likelihood	-97.952	-99.429	-95.566	-96.377
LR chi^2(23)	76.552	73.598	-	-
LR chi^2(25)	-	-	81.324	_
Wald chi^2(24)	-	-	_	76.17
Pseudo R^2	-	-	_	0.2925
Prob > chi2	0.000	0.000	0.000	0.000

In the brackets are reported statistics Z, *** significant at 1%; ** significant at 5%; * significant at 10%; source: Farm household survey, 2006/2007.

of them. PMIS components often receive lower rank (almost 3 and higher) as compared to personal/professional networks. Several insufficiencies with the implementation of PMIS in Benin have been observed. First, farmers complained that the data that are published are not for the local (village) markets where they prefer to do their transactions, but rather for distant (regional or urban) markets. Suppose, for instance, that a

Table 4. Marginal effects for the Nested logit model for the choice of the modes of transaction for maize.

Variables	Marginal effects
Alternative-specific constants	
Contract	-0.17336433
Distant market	-0.11111135
Alternative-specific variables	
PE	-0.00004654
CO	-0.00040078
DI	-0.00306893
DU	0.00136172
Individual-specific variables	
PMIS *contract	-0.10167812
PMIS *distant market	0.04384046
CPV *contract	-0.25268141***
CPV * distant market	0.00499567
EXP *contract	-0.00406977
EXP * distant market	0.00124072
INST*contract	-0.00082952
INST* distant market	0.00529882
T *contract	0.01073001
T * distant market	0.00328786
COM *contract	-0.01539053
COM * distant market	-.00875026
GP *contract	0.4175454***
GP * distant market	0.05981317
PM *contract	0.1223692
PM * distant market	-0.0051499
VAR *contract	-0.01130172
VAR * distant market	0.00567072

farmer has, for several years, been under the mode ‘contract with itinerant traders’ and is therefore, not connected to good professional networks from which reliable market quotes can be obtained, if he wants to move to the mode ‘village market without market’, he needs primarily a market data for the village markets but currently PMIS cannot provide this. Unfortunately, currently in Benin, PMIS cannot provide such data. Only market data for more distant (regional) markets are published. This means that farmers can receive PMIS data but, obviously, these data will be less helpful, if they see the move to the mode ‘village market without contract’ as the most efficient alternative choice.

Secondly, it has been observed that the price data shown on the message blackboards in the market place across the country are not updated regularly. Thirdly, the broadcastings of the prices and market information through the radio stations are often interrupted, restraining the farmers’ capacity to carry out a good follow-up of the market data. Obviously, significant improvements need to be added to PMIS in Benin to reduce in the first place the imperfections raised. In addition to this, farmers’ capacity to exploit PMIS market data to improve their crop marketing strategies must be strengthened. As Shepherd (2000) emphasizes, agricultural extension services must also be able to help producers to obtain information about market opportunities, to find buyers, decide about quantity to produce, quantity to sell, to whom to sell, where to sell and when to sell, etc. Unfortunately such programs are often absent from the agenda of the agricultural extension administration in Benin or they are placed at the bottom on the list of priorities. A close co-operation with farmers will be useful for these interventions to be successful. The data showed that in the survey villages, there is the existence of a good capacity in the area of crop marketing supported by well-established personal/professional networks. The latter are well aware of the value of market information and try various solutions by themselves to reduce the problems of access to information for their members.

Nevertheless, how such a co-operation can be implemented in the social, cultural and political contexts

Table 5. Farmers' perceptions on the reliability of the main sources of market information (n=124).

Sources of market information	Average rank*
Traders	1.6
Friends and relatives	1.5
Monthly market bulletin ONASA	6
Community radio stations	2.5
National radio station	2.9
Message blackboards in market places	3

*1= highly reliable; 6 = reliability is worst; source: farm household survey, 2006/2007.

of rural Benin needs to be carefully studied.

The results for 'nested logit 3' showed also that the farm size is associated to the modes of transaction. They indicated that large-scale and medium-scale farmers (that is, those with larger surpluses) are more prepared to accept a contract with itinerants traders for selling their maize surpluses to small-scale farmers that move to the market (village or distant). Given that this result is obtained after controlling the model for PMIS, interesting conclusions can be derived. Given that the use of PMIS induces higher received prices as shown in Table 2, this means that 'big' farmers use purposively PMIS to improve benefits from transactions while remaining under contract. Contract may not be the best choice and we have seen that as soon as access to information is facilitated, farmers tend to break out from this mode of transaction. Therefore, the question arises 'why does this mode persist?' A plausible answer is that farmers lack access to credit; indeed a key advantage of contract in the study area is that this mode is accompanied by an offer of credit by itinerant traders. It is useful to find out how the patterns of modes of transaction will be altered if farmers are offered an alternative source of credit in addition to the implementation of PMIS. Two additional results from the model can be mentioned. Except the variables for the reception of information, the coefficients for the rest of the individual-specific variables are not significant, the same is found for the alternative-specific variables.

An important difficulty with the results shown in Table 3 needs to be tackled. Like in any econometric model using survey data, it will be argued that the variable for information is endogenous. The likelihood of this argument was obvious at the beginning of this research, so we adjusted the survey approach to reduce this problem. For instance, as stressed before, the variables for information were constructed carefully. These variables do not simply indicate 'access' or 'use' of information. Rather, during the survey, farmers had to indicate whether they have received any information (and from where) and whether the market data learned were a decision factor for the choice of the particular mode of transaction they have selected in the survey year. The problem with reverse causation is probably further reduced because of the type of contract observed in the survey area. Within the framework of such a contract, farmers are not bound 'forever' to traders. They are free to change the modes of transaction from one season to another, which is similar to the findings of Smith et al. (1999) and Fafchamps and Gabre-Madhin (2006). In such contexts, we should expect that the patterns of modes of transaction will be determined by the farmer's capacity to receive sufficient and reliable market information and not the opposite.

Nevertheless, we suggest viewing the results of the models in Table 3 basically as correlation rather than causal relationships. Of course, biases due to endogeneity may have not been completely eliminated because these models are implemented based on survey data. To infer consistent causal relationships, for example, by implementing an impact analysis, an improved dataset is required (for example, experimental data). In spite of this difficulty, the model presented in Table 3 is useful. It is often a necessary step to implement successfully an impact analysis in poor countries, in particular, where data are often scanty. Apart from this, a few, if any, studies has tested the association between the reception of PMIS information by farmers and their modes of transaction in Benin in a systematic way as proposed in this paper. Insights from this research can be used to implement a more consistent assessment on this issue.

Conclusions

In this research, we studied to what extent small-scale farmers are aware of the value of market information and on what sources of information they rely to make crop marketing choices in rural Benin. In particular, we test whether an association exists between the reception of market information conveyed through the Public Market Information System (PMIS) and the modes of transaction for the major staple food crop (maize).

To sell their surpluses of maize, the main staple in Benin, farmers can choose among three modes of transaction, each of which yields a different benefit: they can sell under a contract established at the onset of the crop season with itinerant traders, or they can sell without a contract at the farm gate (village market) or on distant (urban) markets. It has been postulated that farmers will

choose a profitable mode of transaction if they can receive reliable market information on the prevailing market conditions. Using detailed farm household survey data from Benin, this paper applies the Random Utility Maximization Nested Logit (RUMNL) model to test this hypothesis. The results showed that farmers will opt to sell at the farm gate or on distant markets without a contract if they can receive reliable market information. However, such a decision may not be related to the reception of market information channeled through the government-supported 'Market Information System' but rather it is associated to information obtained from the farmers' personal/professional networks.

This result does not invalidate the role of PMIS but rather it reinforces the importance of this system. The message is that the government-supported MIS in Benin needs to be improved to be effective. The data indicated that a key improvement will be to start publishing prices and other market data not only data for distant (regional or urban) markets, but primarily for local (village) market on the community radio stations. Interruption of the broadcastings of these data on the radio stations, like it is frequently observed these days in Benin, is also to be avoided. As a complementary intervention, a training program in the area of food marketing for farmers needs to receive a higher position on the list of the priorities of the agricultural extension administration in the country.

The results of the study indicated that many farmers prefer to sell under contract rather than to sell freely in the market because itinerant traders provide them with credit to accompany the contract. How the patterns of the modes of transaction will be altered if farmers are offered an alternative source of credit, in addition to the provision of PMIS, remain an open question.

ACKNOWLEDGEMENTS

Authors would like to thank Belgian Technical Cooperation BTC) and International Foundation for Science (IFS) both of which provided research grants for this study. We also thank participants to the conference of African Economic Research Consortium (AERC) on "Agriculture (for Development in sub-Saharan Africa" held in Mombassa (May, 2009) for useful comments. The prize received from Centre of Evaluation for Global Action (CEGA), University of California, for this paper is gratefully acknowledged. Special thanks to three anonymous referees for their numerous and useful comments.

REFERENCES

Adégbidi A, Dèdèhouanou H et Kpènavoun Chogou S, Lutz C (2003). Ten Years of Market Liberalization on Corn Bénin. Centre for Development Studies (CDS), Res. Report, University of Groningen, The Netherlands, 20: 1-106.

Ahohounkpanzon M (1992). Economic Analysis of circuits in the Corn Marketing Department of the Atlantic (South Benin). PhD thesis of the third cycle in Economics. Abidjan: CIRES.

Barrett CB (2008). Smallholder market participation: Concepts and evidence from eastern and southern Africa. Food Policy, 33: 299–317.

Ben-Akiva M, Lerman SR (1985). Discrete Choice Analysis: Theory and Application to Travel Demand. The MIT Press, Cambridge: Massachusetts.

de Janvry A, Sadoulet E (2006). Progress in the Modeling of Rural Households' Behavior under Market Failures. In De Janvry A and Kanbur R (eds). Poverty, Inequality and Development. Essays in the Honor of Erik Thorbecke. Kluwer Publishing.

de Janvry A, Fafchamps M, Sadoulet E (1991). Peasant Household Behavior with Missing Markets: Some Paradoxes Explained. Econ. J., 101(409): 1400-1417.

Fafchamps M, Gabre-Madhin E (2006). Agricultural Markets in Benin and Malawi. *AfJARE,* 1(1): 67-94.

Fafchamps M, Hill V (2005). Selling at the Farmgate or Travelling to Market. Am. J. Agr. Econ., 87(3): 717-734.

Galtier F (2002). Information, Institutions and Market Efficiency. Analysis of three cereal sectors of West Africa as "Communication Systems". Thesis presented at the Ecole Nationale Superieure Agronomique de Montpellier for the doctoral degree in economics, Montpellier, France.

Goetz S (1992). A Selectivity Model of Household Food Marketing Behavior in Sub-Saharan Africa. Am. J. Agr. Econ., 74(2): 444-452.

Heiss F (2002). Structural Choice Analysis with Nested Logit Models. The Stata J., 2(3): 227–252.

Lutz C (1994). The Functioning of the Maize Market in Benin: Spatial and Temporal Arbitrage on the Market of a Staple Food Crop. PhD thesis: University of Amsterdam (the Netherlands).

Minot N, Kherallah M, Soulé BG et Berry P (2001). Impact of Agricultural Reforms on Small Farmers in Benin. Report, Volume 1: Results of Surveys of Small Farmers, Communities, and Village Associations. IFPRI, Washington, D.C.

North DC, Wallis J (1994). Integrating Institutional Change and Technical Change in Economic History: A transaction Cost Approach. J. Inst. Theoretical Econ. 150(4): 609-624.

Shepherd AW (2000). Market Information Services - Theory and Practice. FAO Agricultural Services Bulletin 125, Rome: FAO.

Silberhorn N, Boztug YL, Hildebrandt L (2008). Estimation with the Nested Logit Model: Specifications and Software Particularities. OR Spectrum, 30: 635-653.

Smith LED, Stockbridge M, Lohano HR (1999). Facilitating the Provision of Farm Credit: The Role of Interlocking Transactions Between Traders and Zamindars in Crop Marketing Systems in Sindh. World Devel., 27(2): 403-418.

Suarez A, del Bosque IR, Rodriguez-Poo JM, Moral I (2004). Accounting for Heterogeneity in Shopping Centre Choice Models. J. Retailing Consumer Services, 11: 119-129.

Tassou Z (2004). Liberalization of Agricultural Markets and Coordination of Exchanges of Food Products: The Role of Associations of Merchants in Benin. PhD Thesis, Montpellier INRA.

Tollens EF (2006). Market Information Systems in Sub-Saharan Africa: Challenges and Opportunities. Poster paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August, pp. 12-18.

Train K (2003). Discrete Choice Methods with Simulation. Cambridge University Press.

Vakis R, Sadoulet E, de Janvry A (2003). Measuring Transactions Costs from Observed Behavior: Market Choices in Peru. Department of Agricultural & Resource Economics, UC Berkeley, Working Paper Series p. 962.

Williamson OE (2002). The Theory of the Firm as Governance Structure: From Choice to Contract. J. Econ. Perspect, 16(3): 171–195.

Williamson OE (1991). Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. Admin. Sci. Q., 36(2): 269-296.

World Bank (2001) Word Development Report 2000/2001. Attacking Poverty: Opportunity, Empowerment and Security., Washington D.C.: The World Bank.