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# Determinants of the choice of multi-governance structures by producers and processors of paddy in Benin

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**This study aims to analyse the factors that influence the selection of governance structures by rice producers and processors in Benin. Unlike previous studies, the factors that influence the selection of governance structures are identified simultaneously for both producers and processors of paddy. Data were collected in Benin from about 300 producers and 140 processors of paddy randomly selected. The results indicate that 78% of producers and 92% of the processors use spot market for paddy transaction. Around a quarter of producers use at least two governance structures to sell paddy. Producers and processors belonging to an innovation platform are more likely to use formal contracts in their transactions. Also, producers and processors are more likely to use credit payment mechanism with formal contract. The findings suggest that innovation platforms can be used to facilitate contractual relationships between paddy producers and processors.**

**Key words:** Multivariate probit, market dynamics, African rice value chains, governance mechanisms.

## INTRODUCTION

Global agri-food systems are undergoing significant changes due to the globalization of supply and marketing, the use of quality standards, and product differentiation (Reardon et al., 2009). These responses to liberalization have led to the opening of domestic markets to imported products. As a result, actors of domestic value chains, especially those in developing countries, need to organize their activities to effectively cope with the competition from imported products. In this sense, buyers in domestic value chains often look for suppliers that can abide by the requirements of quality, quantity, and delivery time in order to cope with market demand (Weatherspoon and Reardon, 2003; Poulton and Lyne, 2009). However, small-scale producers in developing countries face many

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constraints that limit their ability to abide by the requirements set by buyers. These constraints include a limited access to credit and production inputs (e.g. seeds and fertilizers) as well as a lack of information on production technologies (Bijman, 2008; Reardon et al., 2009; Barrett et al., 2012).

The negative impacts of these problems on farmers can potentially be addressed through improved market coordination among farmers and other value chain actors (Vroegindewey, 2015). A strategy commonly used to improve market coordination is to adopt buyer-supplier governance structures, such as contracts and long-term partnerships (Prowse, 2013; Reardon et al., 2009). Governments and development actors are increasingly considering using these governance structures as tools to reduce poverty and stimulate agricultural growth (Jia and Bijman, 2014). The key challenge to the development of African rice value chains is the need to improve the governance of quality (Rizzoto and Demont, 2011; Demont and Rizzoto, 2012). However, the force of only spot market is not enough to face the challenge of quality. Accordingly, other governance mechanisms, such as contracts, alliances and vertical integration, are needed to ensure that producers and processors cope with the changing demands of consumers (Swinnen et al., 2010).

A governance structure is an organizational option used by an economic agent to carry out a transaction. Economic agents, when coordinating their activities, adopt governance structures which, according to Williamson (1975), allow them to minimize transaction costs. The governance structures include the spot market, the hybrid or contractual forms, and the hierarchy. The choice of a governance structure or their combination is mainly influenced by the attributes of the transaction. A thorough understanding of the factors that influence the choice of the governance structures is pivotal to design policies that promote a better coordination of activities along rice value chain. As a result of a better value chain coordination, actors can provide consumers with rice that meet their preference.

Theoretically, the choice of a governance structure depends on the importance of the transaction costs related to each governance structure (Renkow et al., 2004; Vakis et al., 2003; Williamson, 1975). However, these transaction costs are difficult to quantify. Thus, this research follows Kpenavoun (2009) and Arinloyé (2013) and focuses on the factors that determine these costs, which are socioeconomic factors, the attributes of the transaction, and the institutional environment. The socioeconomic factors that influence the selection of a governance structure may include the farm size, the age of head of household, the gender, and the level of education of the farm manager (Arinloyé, 2013; Kpenavoun, 2009; Polson and Spencer, 1991). In terms of transaction attributes, Williamson (1979) explains that economic transactions have three main attributes: Asset specificity, uncertainty, and frequency of the transaction. These determine the extent and nature of transaction costs and are pivotal in the decision of governance structures selection.

Asset specificity is the difficulty of using assets for alternative transactions, or their non-redeployability (Moustier, 2012). When the assets involved in a transaction are generic and non-specific, the most effective governance structure is to use the market. However, when asset specificity is average, the company will use a hybrid form if the level of uncertainty is not too high (Williamson, 1996; Bensalk, 2013). Uncertainty includes internal and external disturbances to which transactions are subject (Williamson, 1979). In the presence of uncertainty, agents can be tempted or may attempt to renegotiate the terms of the original agreement. However, a negotiation can increase the cost of contracting and thus the effectiveness of the agreement. A high level of uncertainty will discourage the supplier from investing in specialized assets if appropriate safeguards are absent (Lu, 2007).

The frequency of the transaction affects transaction costs and has an ambiguous effect on the mode of organization (Crocker and Masten, 1996). However, the more the transaction is repeated, the better the partner is known and the harder it becomes to a partner to be opportunistic (Williamson, 1985; Bensalk, 2013). Accordingly, it is advisable to use a governance structure that minimizes opportunistic behaviour (Royer, 2009; Bensalk, 2013). Several recent researches in the rice sector in Benin have examined the issue of competitiveness of rice production (Codjo et al., 2016; Adegbola et al., 2003). However, few studies have addressed the organizational facet of rice value chain. Unlike previous studies addressing the issue of governance structures selection (Arinloyé, 2013, Kpenavoun, 2009), this paper considers both producers and processors. Producers sell paddy to processors through various governance structures. Processors of paddy; however, are the buyer of paddy, which one is processed to obtain the milled rice. Accordingly, looking at jointly the factors that influence the selection of governance structures by the buyers and sellers of paddy may be important to guide the design of policies to promote the selection of suitable governance structures.

## METHODS

### Description of study area

This study was conducted in the rice development hub of lowland rice and strict rainfed rice of Benin. This rice development hub is in the central part of Benin and known as Glazoué rice development hub. This hub includes the districts of Glazoué, Dassa, Savalou and Bantè. A rice development hub is a part of an agro-ecological zone of a country with a strong concentration of integrated research and extension work along the rice value chain for more impacts (AfricaRice, 2015). It is also a multi-stakeholder partnership operating

**Table 1.** Number of villages and respondents per district.

| District | Producers | | Processors | |
|---|---|---|---|---|
| | Number of villages | Number of respondents | Number of villages | Number of respondents |
| Dassa | 10 | 70 | 5 | 41 |
| Glazoué | 12 | 78 | 6 | 52 |
| Savalou | 9 | 66 | 4 | 21 |
| Bantè | 10 | 86 | 5 | 26 |
| **Total** | 41 | 300 | 20 | 140 |

**Table 2.** Description of variables included in the regression model.

| Variable | Description | Level |
|---|---|---|
| **Socioeconomic characteristics** | | |
| Belonging to an innovation platform | Binary variable indicating if actor i belongs to an innovation platform | 0 = No, 1 = Yes |
| Agricultural training | Binary variable indicating if actor i received agricultural training | 0 = No, 1 = Yes |
| Sex | Binary variable indicating the sex of actor i | 0 = Women, 1 = Men |
| Actor | Binary variable indicating the type of actor i | 0 = Processor, 1 = Producer |
| **Information, search, and bargaining costs** | | |
| Location of the transaction partners | Binary variable indicating if the transaction partners are in the same village | 0 = Not the same village, 1 = Same village |
| Existing of middleman for the negotiation | Binary variable indicating if the negotiation is made by a middleman or not | 0 = No, 1 = Yes |
| Mechanism of payment | Binary variable indicating if the producer is paid at the delivery or not | 0 = No, 1 = Yes |

in synergy on value chains (processing, marketing, etc.) to promote rice in a given area.

### Source of data and sampling method

Producers and processors were randomly selected. At the producer level, a list of villages active in rice production was established in each of the districts forming the rice development hub of Glazoué, with the assistance of members of the rice producers' associations. Thus, 15 villages were identified as being active in the district of Bantè, 14 in the district of Savalou, 16 in the district of Dassa, and 19 in the district of Glazoué. Forty-one (41) villages were selected randomly from the pool of villages (Table 1). At the level of each selected village, the list of rice-producing households is set with the assistance of producer associations' leaders. This list is supplemented by a census of the other producers of the village. A total of 300 producers randomly selected from forty-one (41) villages were surveyed. As in the case of producers, rice-processing villages were randomly selected in each district. In each village, a list of processing units was established with the assistance of the leaders of associations of processors. Rice processors considered in this study are those who purchase paddy, parboil it or not, and sell the milled rice after the milling of paddy. The millers that provide just a milling service and do not purchase paddy to mill and sell the final product as a milled rice are not included in this study. Then the processors were randomly selected in each selected village. Thus, a total of 140 processors were surveyed in 20 villages.

### Empirical model

A governance structure defines the type of agreement that exists between the producer and the processor of paddy. This research focuses on four governance structures: The spot market, formal contracts (written), informal or relational contracts, and producer associations. This study focused on the socioeconomics characteristics and information, search, and bargaining cost to explain the choice of governance structures. In line with Arinloyé (2013) and Getachew (2009), the choice of governance structure made by an actor may be explained by the socioeconomic characteristics of the household ($HH_i^k$) and the information, search and bargaining costs ($ISB_i^p$). The socioeconomic characteristics of the household are included in the model to account for the effect of individual characteristics on the choice of governance. Table 2 presents the explanatory variables included in the model together with their descriptions and levels.

The empirical model is as follows:

$$\begin{cases} SM_i = \alpha_0 + \sum_{K=1}^{4} \alpha_{1i} HH_i^k + \sum_{p=1}^{3} \alpha_{3i} ISB_i^p + \varepsilon_a \\ FC_i = \beta_0 + \sum_{K=1}^{4} \alpha_{1i} HH_i^k + \sum_{p=1}^{3} \beta_{3i} ISB_i^p + \varepsilon_b \\ IC_i = \gamma + \sum_{K=1}^{4} \gamma_{1i} HH_i^k + \sum_{p=1}^{3} \gamma_{3i} ISB_i^p + \varepsilon_c \\ AP_i = \delta_0 + \sum_{K=1}^{4} \delta_{1i} HH_i^k + \sum_{p=1}^{3} \delta_{3i} ISB_i^p + \varepsilon_d \end{cases}$$

with $SM_i$, $FC_i$, $IC_i$, $AP_i$, binary variables, taking the value 1 if actor i (producer or processor) chose respectively the spot market, formal contracts, informal agreements and producer association and 0 if not. $HH_i^k$, a vector of variable representing the socioeconomic characteristics of actor i, $ISB_i^p$, a vector of variable representing the information, search and bargaining costs of the actor I, and ε the error term.

A multivariate probit model (MVP) or seemingly unrelated regression (SUR) can be used to estimate the model. The SUR model is used in the case where the dependent variables are continuous. As part of this research, the dependent variables are dichotomous. Therefore, the right model for the estimate is MVP (Cappelari and Jenkins, 2003). This model allows the analysis of the relationship between the dependent variables considered (Arinloyé, 2013; N'cho, 2014). It also allows us to consider the multiple choices of governance structures by the actors.

## RESULTS AND DISCUSSION

### Socio-economic characteristics of producers and processors

Table 3 presents the socio-economic characteristics of the paddy producers and processors that were surveyed. On average, producers were older than processors. The t-test suggests that there is significant difference in the mean of age and cultivated area across producers and processors. Rice production was dominated by men (62.82%). Processing activities were dominantly performed by women (94.70%), who use traditional or modern equipment to parboil the paddy. Processing of white paddy rice is sometimes performed by the men who own the processing units. More than half of the producers and processors have received no formal education, although more than 80% have undergone agricultural training. A chi square test of independence suggests that agricultural training is not related to the type of actors. Accordingly, there is independence between the type of actor and agricultural training. However, the chi square test of independence revealed that participation in innovation platforms activities is related to the type of actor. Around 30% of producers and 56% of processors belong to an innovation platform. Innovation platforms were created in response to rice producers and processors unequal access to information and resources that are necessary for the development for rice value chain (Hinnou et al, 2018). While reducing disparity about access to information, innovation platforms bring together actors including, producers, processors, seed providers, retailers, middlemen, financial institutions and others. Innovation platforms are used to facilitate the access of actors to production resources and marketing relationship.

### Types of governance structure used

Based on the exploratory phase, there are four governance structures used by producers and processors: (i) spot market; (ii) formal contract (written contract that gives details about rice transaction between a producer and a processor); (iii) informal contract (oral contract between a producer and a processor); and (iv) association of producers (only producers belonging to the association can sell their product to the association).

Figure 1 shows the distribution of producers and processors by governance structures used to exchange the paddy. These actors mainly use the spot market for their transactions. In all, 78.04% of the producers and 92.59% of the processors use the spot market. This result is consistent with that of Arinloyé (2013), which found that more than 90% of the pineapple farmers in Benin use the spot market to sell their products. These results are also supported by those of Ji et al. (2012), who found that the spot market represents 81% of pork transactions in Ethiopia. However, few actors are engaged in informal contracts and producers' associations for marketing their paddy. This contrasts with the results of Arinloyé (2013), which found that 58% of pineapple producers sell through relational contracts and 41% through producer associations. In this study, only 13% of rice producers and 11% of processors use relational contracts. About 14% of paddy producers sell their rice through producer associations.

### Number of governance structures used

Table 4 shows the distribution of producers and processors by the number of governance structures used. Actors using more than one governance structure combine one or more of the alternatives available to them. It appears that almost 68% of producers use only one governance structure to market their paddy, while about 32% use at least two governance structures. Concerning processors, 74% use a single governance structure to procure paddy, with 25% using at least two governance structures. This contrasts with the results of Arinloyé (2013), which found that 80% of pineapple producers in Benin uses at least two governance structures. Using multiple governance structures is a strategy to level off the revenue.

**Table 3.** Socio-economic characteristics of the sample.

| Characteristic | All | Producers | Processors | P-value |
|---|---|---|---|---|
| **Age (mean)** | 44.82(10.38) | 46.75(10.23) | 40.78(9.52) | 0.000[a] |
| **Sex (%)** | | | | 0.000[b] |
| Men | 44.25 | 62.82 | 5.30 | |
| Women | 55.75 | 37.18 | 94.70 | |
| **Formal education (%)** | | | | 0.005[b] |
| No | 56.48 | 51.62 | 66.67 | |
| Yes | 43.52 | 48.38 | 33.33 | |
| **Agricultural training (%)** | | | | 0.145[b] |
| No | 14.18 | 15.88 | 10.61 | |
| Yes | 85.82 | 84.12 | 89.39 | |
| **Cultivated rice area (ha)** | 1.07(1.95) | 1.33(2.29) | 0.53(0.62) | 0.000[a] |
| **Belonging to an innovation platform (%)** | | | | 0.000[b] |
| No | 62.1 | 70.76 | 43.94 | |
| Yes | 37.90 | 29.24 | 56.06 | |
| **Number of respondents** | 440 | 300 | 140 | - |

Standard errors in parenthesis; a: t-test is used to analyse the mean difference significance; b: Chi square test of independence is used to analyse the association between variables.

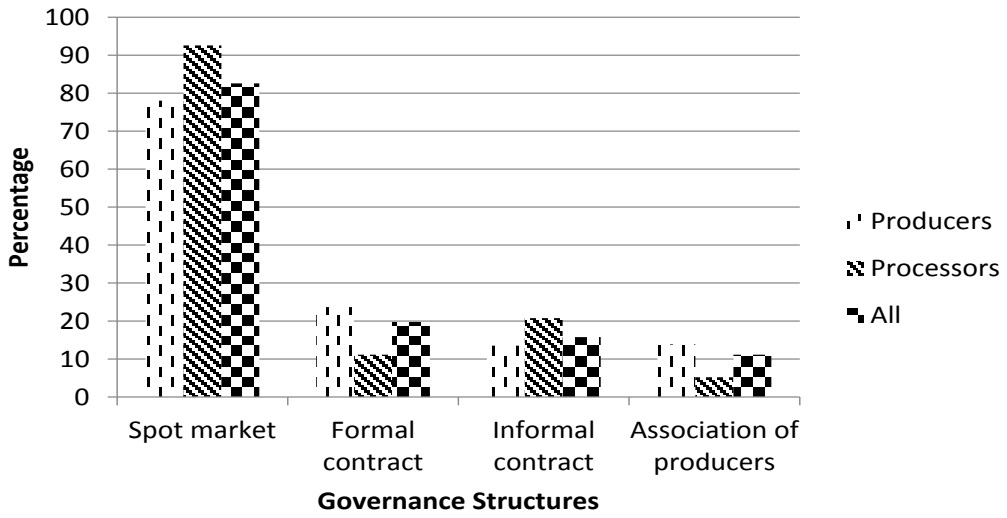


**Figure 1.** Distribution of producers and processors by governance structures.

**Table 4**. Number of governance structures in which actors are involved.

| Number of governance structures* | Producers | | Processors | | All | |
|---|---|---|---|---|---|---|
| | Obs* | Percent (%) | Obs | Percent (%) | Obs | Percent (%) |
| 1 | 188 | 67.87 | 99 | 74.43 | 287 | 70 |
| 2 | 73 | 26.35 | 27 | 20.03 | 100 | 24.39 |
| 3 | 16 | 5.78 | 6 | 4.5 | 22 | 5.36 |
| 4 | 0 | 0 | 1 | 0.75 | 1 | 0.24 |
| **Total** | 277 | | 133 | | 410 | 100 |

*Obs=Observation.

**Table 5.** Results of multivariate probit estimation for governance structure choice.

| Socioeconomic characteristics | Governance structures | | | |
|---|---|---|---|---|
| | Spot market (SM) | Formal contract (FC) | Informal contract (IC) | Association of producers (AP) |
| Belonging to an innovation platform | -0.54***(0.19) | 0.82***(0.17) | -0.01(0.17) | 0.14(0.18) |
| Type of actor | -0.77***(0.25) | 0.63***(0.22) | -0.49**(0.21) | 0.48*(0.26) |
| Sex | 0.02 (0.019) | -0.22(0.18) | -0.37**(0.19) | -0.24(0.19) |
| Agricultural training | -0.37(0.33) | 0.38(0.28) | 0.21(0.24) | 0.65*(0.34) |
| **Information, search and bargaining costs** | | | | |
| Location of the transaction partners | 0.92***(0.23) | -0.79***(0.17) | –0.27*(0.15) | -0.26(0.19) |
| Existing of middleman for the negotiation | -0.04(0.20) | 0.24(0.18) | 0.11(0.17) | 0.25(0.20) |
| Mechanism of payment | 0.39(0.24) | -0.87***(0.23) | -0.20(0.22) | –0.24(0.26) |
| $\rho FC * SM$ | 0.80*** | | | |
| $\rho IC * SM$ | -0.27*** | | | |
| $\rho AP * SM$ | -0.06 | | | |
| $\rho IC * FC$ | 0.26*** | | | |
| $\rho AP * FC$ | -0.09 | | | |
| $\rho AP * IC$ | 0.18* | | | |
| **Number of observations** | 410 (277 producers and 133 processors) | | | |
| **Wald chi$^2$(df)** | 125 (77)*** | | | |
| **Likelihood ratio test, $H_0$: ρ21= ρ31= ρ41= ρ32= ρ42= ρ43=0; chi$^2$(6)=101.21*** ** | | | | |

*Significant at 10%; **significant at 5%; ***significant at 1%; standard errors in parenthesis.

## The choice of governance structures

The results of the MVP model are presented in Table 5. The Wald test was used to examine whether any of the parameters of the model that currently have non-zero values could be set to zero without any statistically significant loss in the model's overall fit to the data. This test the overall significance of the variables included in the econometric model (McGeorge et al., 1997; Ryan and Watson, 2009). The results show that the Wald Chi$^2$ is statistically significant at 1% level, indicating that the subset of coefficients of the model are jointly significant and that the explanatory power of the factors included in the model is satisfactory. The factors included in the model explain the choice of different governance structures by rice producers and processors.

The likelihood ratio of the null hypothesis of independence (ρFC*SM = ρIC*SM = ρAP*SM = ρIC*FC = ρAP*FC = ρAP*IC) between the decisions of choice of different governance structures is significant at 1%. Thus, the null hypothesis of independence between the decisions of choice of governance structures is rejected. The values of rho (ρij) indicate the degree of correlation between governance structures taken in pairs. The values of rho ρFC*SM, ρIC*FC, and ρAP*IC are significant at the 10% level with associated positive values. From these results it can be concluded that the actors who use the spot market to exchange paddy are more likely to use formal contracts.

Belonging to an innovation platform is an important factor that influences the choice of governance structures. This variable is positively and significantly correlated with formal contracts. Therefore, actors who use formal contracts to exchange paddy are more likely those who belong to an innovation platform. Indeed, the platform is a tool used to facilitate the connection between actors. It allows them to meet, share knowledges and build business relationship. Therefore, the processors belonging to an innovation the platform sign contracts with producers to ensure a reliable supply of the raw material (paddy).

Participation in agricultural training has a significant and positive influence on the use of producer associations. This influence could be justified by the fact that most trainings initiated for the stakeholders in rice value chain are carried out through producer associations. These results confirm those of Arinloyé (2013), which explains that the institutional support received by producers influences the choice of governance structures.

The type of actor negatively and significantly (5%) influences the choice of spot market and informal contract. Thus, the processors are more likely to use these governance structures than producers. This can be justified by the fact that processor generally combine the other governance structures to spot market. Indeed, even

**Table 6.** Predictions of probabilities of participation in different governance structures.

| Mode of governance | Minimum | Mean | Maximum |
|---|---|---|---|
| Spot market | 0.50 | 0.87 | 0.99 |
| Formal contract | 0.01 | 0.21 | 0.86 |
| Informal contract | 0.004 | 0.17 | 0.38 |
| Association of producers | 0.003 | 0.11 | 0.34 |
| All four governance structures | 0.0001 | 0.004 | 0.035 |
| Zero mode of governance | 0.0003 | 0.013 | 0.067 |

though the processors use formal contracts and farmers associations for their procurement, they can request additional quantities on spot market. Processors may receive an order of milled rice at any time throughout the year and they may not have enough paddy to meet such demand. Accordingly, processors may refer to spot market anytime to request paddy.

The location of transaction partners positively and significantly (1%) influence the choice of spot market and negatively and significantly (1%) the choice of formal contract. Therefore, when the producer and the processor are in the same village, they use more spot market. In contrast, when the transaction partners are in the different village, they conclude the exchange through a formal contract. The mechanism of payment negatively and significantly (1%) influences the choice of formal contract. Thus, the cash payment at the delivery of paddy is more use on spot market and less with formal contract. This suggests that actors that use formal contracts are more likely to use credit payment mechanism.

### Predictions of probabilities of participation in different governance structures

After estimating the MVP model, it is possible to predict the probability of the participation of actors in different governance structures, the probability of simultaneously participating in all the governance structures, and the probability of participating in any single mode of governance. Table 6 presents estimates of these predictions. The spot market has the highest predictive probability of participation. Therefore, the current situation favours the involvement of actors in the spot market. The probability of actors participating in formal contracts is 0.21 and that of them participating in informal contracts is 0.17. The probability of actors failing to adopt any form of governance is very low. Thus, different actors are more likely to participate in the spot market.

## Conclusion

This study analysed the determinants of the choice of governance structures selected by producers and processors of paddy in Benin. Four governance structures were selected; namely the spot market, the formal contract, the informal contract, and producer associations. To identify the factors influencing the choice of these governance structures, the analyses focused on the socioeconomic characteristics of respondents and the information, search and bargaining costs. The results showed that 78% of producers and 92% of the processors mainly use spot market for transactions of paddy. In addition, 67% of producers and 74% of processors use mostly a single governance structure for the transactions of paddy. The use of formal contracts is positively correlated by the participation in an innovation platform. Participation in agricultural training positively influences the use of producer associations. The results suggest that efforts to promote contractual governance structures should focus on innovation platforms by making existing platforms more dynamic and encouraging additional actors to engage. This will facilitate interactions among producers or suppliers and processors or buyers. Greater engagement in innovation platforms should also have the effect of increasing the quantity and quality of paddy produced and traded. Building on this study, future research could explore the factors that explain actors' adoption of contracts. These studies could focus on the identification of attributes of contracts that are conducive to actors' participation in contracts.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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