THESIS / THÈSE

SPECIALISED MASTER IN INTERNATIONAL AND DEVELOPMENT ECONOMICS

Understanding the Performance of Agro-Business Value Chains in Benin Case Study of Cashew nuts.

Olodo, Sourou

Award date:
2020

Awarding institution:
University of Namur

Understanding the Performance of Agro-Business Value Chains in Benin: Case Study of Cashew nuts.

Thesis presented by

Sourou Marius OLODO

Supervisor(s)

Prof. Romain HOUSSA (UNamur)

Tutor(s)

Elena BRIONES ALONSO/Modeste DAYE (UNamur)

Academic year 2019-20

Project presented as part of the requirements for the award of the Specialized Master in International and Development Economics Jointly organized by the ESLN and the ESL

Département des Sciences économiques/UNamur • Rempart de la Vierge 8 • 5000 Namur
Ecole d'économie de Louvain/UCL • Place Montesquieu 3 • 1348 Louvain-la-Neuve

Acknowledgement

Our sincere thanks to:

- the management staff (academic and administrative). Special thanks to Professor Romain HOUSSA for his personal implication in the realization of this work;

- the tutors Elena BRIONES ALONSO and Modeste DAYE for their follow-up and advice for the improvement of the work;

- finally to all those who have contributed to this study.

Table of contents

List of tables

List of figures

List of graphs

Abstract

In recent years, market power of small famers from developing countries has emerged as important economics issue. This market power is measured by the markup. We contribute to this literature by focusing on the exchanges between cashew farmers and buyers on Benin's cashew domestic market. We use data on 261 cashew nut producers to highlight the determinants of farmers' markup in the Atacora-Donga region of Benin. The results show that the markup is significantly correlated with production and sales characteristics, farmers' characteristics, but also by the type of buyer and the financial situation of the farmers or their organisation.

Keywords: *Cashew nuts value chain; Markup; Rents sharing; Benin; Globalization.*

I- General context, motivation and research question

Globalization through its corollary of market integration and economic interdependence has led to a restructuring of international trade. A reorganization is observed through the increase of norms and standards for agricultural products (Maertens and Swinnen, 2015). And it is not without consequences for small producers in developing countries characterized by the poverty of their populations. Developing countries care about the income generated by agricultural trade (through export crops), which is one of the main sources of their exports revenues. Agriculture plays an important role in developing countries' poverty reduction (Christiaensen et al., 2011). In Benin, an emphasis is placed on the diversification of export crops in the strategic development orientations (IMF, 2011; MAEP, 2017). In fact, increasing the earnings of smallholders (who live in rural areas) in trade could have desirable effects on poverty reduction in the countries concerned. It may therefore be important to understand the earnings of smallholders involved in export crops in developing countries. What are their gains in international trade? What are their shares of the sale revenues from the marketing of the products involved?

Several studies have dealt with the subject of the effects of globalization on the poorest or on small producers. These studies (e.g. Minten et al., 2007, and Harrison, 2006) have generally focused on the capacities of small producers to integrate in the international market. From these studies, it appears that the imposition of standards and norms as well as contracts in trade could be a source of inclusion or exclusion of small producers from international trade. For instance, Houssa and Verpoorten (2015) show that a ban on shrimp exports due to the inability of Benin's shrimp sector to conform to European standards had a negative impact on producers even after the ban was lifted. Another important question is the benefit/profit small producers obtain from their participations in international trade in which a strong vertical structure of value chains exists. In this context of vertical structure, small producers located at the bottom of the scale face exporters or retailers who could benefit more from trade. This raises the problem of bargaining power and share in the gains from the sale of agricultural products (Richard, 2012; De Loecker and Eeckhout, 2018). On this subject, the conclusions are that market power is influenced by the characteristics of producers (in terms of capacities of investment in the production process) who react differently to the advantages of globalisation.

Analysing the participation of small producers of developing countries in international trade is not an easy task. These producers do not operate directly on the international market: their participations take place through intermediaries and exporters who buy their products on the domestic markets. In fact, it is these intermediaries and/or exporters

who are supposed to know the product standards required by the demand side and the collection points of supply side on the domestic markets. This leads us to focus on the interactions between small producers and buyers on the domestic markets to identify the determinants of small farmers' market power. We would like to contribute to this literature by analysing the specific case of small producers in the cashew value-chain in Benin. In terms of production levels, Benin accounts for 3.5% of worldwide cashew nuts production (Ricau, 2013) and exports in cashew are estimated at about 95% of domestic total production of cashew (Allagbé et al, 2014). Cashew nut is Benin's second largest export product in 2018, accounting for 15.66% (after cotton accounting for 54.78% and before oleaginous seeds and fruits accounting for 4.36%) of the total value of exported products (INSAE, 2019). The cashew sector accounts for around 200,000 producers (MAEP, 2017). The importance of cashew nuts as a potential source of income for the country would justify the fixing of selling prices by the State in each marketing year. The cashew nut sector is also included in the government's agricultural recovery plan. However, the price set is not the one systematically applied in field sales. In the 2019 marketing year, for instance (graphs 4 and 5), more than 80% of producers in our survey area (Atacora-Donga) sold their cashew at a lower price than the fixed price of 400 F CFA.

This study characterizes cashew transactions between producers and a range of buyers in Benin's domestic cashew markets. It distinguishes four types of buyers: i) local market, ii) national private, iii) foreign private, and iv) the cashew producers' union. From the producer side, we identify two possibilities: either the producer sells individually its production; or a group of producers sell together. We address the following research questions: What are the determinants of farmer's markup in the cashew value chain in Benin? To which extent the producer has some market power?

Using the ENABEL/ACROPOLIS-BeFinD data on 261 cashew nuts producers, we follow the work of De Loecker and Warzynski (2012) and De Loecker and Eeckhout (2017) and proceed in three steps. First, we estimate a Cobb-Douglas production function in order to capture the elasticity of the variable inputs at the cashew nuts sectoral level. It emerges that variable inputs are the most important inputs for cashew nuts cultivation in the study region. Also, the use of improved seed helps to increase production. However, we find that having a right/proof to use the plot lower the production. Second, we determine the markup for each farmer as the ratio between the elasticity of variable inputs and the share of the value of variable inputs in the total value of the farmer's sales as defined by De Loecker and Warzynski (2012). Third, we regress the markup on the characteristics related to the farmers, production, buyers, selling, finance and training in order to analyse theirs effects.

The results show that variable inputs decrease the markup when spending on fixed inputs allows the farmer to have a higher markup. This shows that the markup makes it possible to identify the farmer's level of technology (De Loecker and Eeckhout, 2018). Compare to male, female farmers doing better with positive effect on the markup. Concerning buyers there are heterogeneous results as union has negative effective on farmer's markup compare to local market for which the effect is positive. Also, we observe that the existence of outstanding loan has a negative effect on the farmer's markup. But this negative effect of loan could be mitigated by the positive effect observe when the farmer's PO is financed by the project PROFI. We suspect an effect of the internal governance of the PO to which the farmer belongs on the level of his markup. In POs with individual sales, there is a positive effect on the markup. Compared to the period before the marketing period, selling nuts during the marketing period has a positive effect on the markup. Indeed, the regulatory price fixed by the government during the marketing period helps farmers to sell at a higher price (by increasing their bargaining power) than before the marketing period.

The rest of the thesis is organized into the following sections. A literature review on market power in the globalization context for the small producers and how to measure the market power through the estimation of markup is discussed in Section II. A background on the cashew value chain in Benin is presented in Section III. Section IV deals with the methodology including the data used, some descriptive statistics and the model used. Section V discussed empirical results. The last section concludes.

II- Literature review

In this section, we discuss the implications of globalization on the possible benefits or disadvantages for smallholders. We also show how the literature addressed the question of market power determinants, how market power is measured and its implications.

1- Globalization and causes of imperfect markets (presence of market power or misallocation of the trade revenues)

"Globalization is the growing integration of economies and societies around the world. This integration is the result of reduced cost of transport, lower trade barriers, faster communication of ideas, rising capital flows, and intensifying pressure for migration" (Collier and Dollar, 2001, p.1). The increase in trade resulting from globalization is leading to an interdependence of economies and a more competitive market through the removal of several barriers to international trade (Ceko, 2013). It is then expected that the marketing of agricultural products, for example by producers, can be done at least at an equilibrium price (price equals to the marginal cost of the producer). However,

"globalization implies both winners and losers among the different actors between and within countries" (Collier and Dollar, 2001, p.1). Although globalization encourages free trade (Collier and Dollar, 2001), there is an increase in standards of the characteristics of agricultural products traded on the international market (Maertens and Swinnen, 2014). These quality and safety standards can lead to non-tariff barriers to global trade and make more difficulty participation into international trade with agricultural products for developing countries (Maertens and Swinnen, 2014). Also, globalization has promoted vertical coordination in value chains that may exclude smallholders from the international trade. As matter of fact, "Vertical coordination refers to the synchronization of the successive stages of a production and marketing system. Methods of vertical coordination include open markets, often referred to as spot markets, contracts, and vertical integration" (Martinez, 2002, p.1).

Vertical coordination can have important advantages for small producers. It facilitates small producers in international trade through improved marketing (Harrigan, 1985). Indeed, vertical coordination could lead to further market opening through the sharing of information on product characteristics that solves the issue of information asymmetry. This could then increase the circulation of products on the market, the benefits for smallholders and their market power. Minten et al. (2007) in their attempt to show the impact of trade on the environment through small producers of vegetable in Madagascar find that standards simplify the integration of small producers into the value chains. Indeed, the increase in standards has allowed small producers to have contracts with Madagascar's largest vegetable exporters. Through these contracts, producers have received training on the use of compost to preserve the environment and comply with international trade standards. The results show an improvement in the productivity of both vegetable products and rice (which is grown during periods when vegetable products are not produced) and in soil fertility and the protection of the environment. This then facilitates poverty reduction through the increase and stability of their incomes. However, the authors remain cautious about generalization in Madagascar as opposite results have been observed for maize exporters in the southwest of the country. Murthy (2011) also conducted a study on the consequences of vertical integration resulting from the increase in norms and standards on exported products. This study involved 86 cotton producers in India. The results show a significant increase in productivity and income among producers with respect to integration.

Vertical integration can also present significant constraints that could weaken the market power of small producers. The definition of agricultural product norms and standards for consumer satisfaction violates competitive market assumptions by leading to possible dissimilarities among products. In fact, to be a competitive market, where

buyers and sellers are price takers, the market must meet three conditions (Sexton, 2012):

- Buyer and seller must be each very small regarding the total size of the market so that no one could influence the price.
- The products of all sellers must be homogeneous in the eyes of buyers.
- Information in the marketplace must be perfect, so that all buyers and sellers are aware of the prices being charged and the characteristics of the products being sold.

But due to the presence of norms and standards concerning the export products, one observes an imperfect market case. Also, globalization has promoted vertical coordination in value chains that may exclude or disadvantage smallholders because of the presence of buyers whose obtain most of the gains from trade (Maertens and Swinnen, 2014). This could be explained by the fact that exporters or buyers are the ones who have all the information (norms and standards) on demand and know where to buy the products. As small producers do not have sufficient market information, buyers benefit from this by receiving high transaction costs. This contributes to weakening the market power of producers by selling products at low prices. Loecker and Eeckhout (2018), however, found that the presence of market power is due to the heterogeneity of the producers/firms. This heterogeneity might stem from disparities cost between firms. But the results of Jan De Loecker and Jan Eeckhout could be a consequence of the presence of standards. Indeed, the increase in standards resulting from demand incurs new investment costs as technology matters (e.g: acquisition of capital and proficiency in production techniques). But they are unable to invest because of their small size and low-income level (Swinnen and Vandeplas, 2011). In that case, either they are excluded from the market or forced to sell at a lower price than what would be possible with a more productive/more advanced technology.

2- Market restructuration and rent sharing

According to Sexton (2012) the market power of buyers which are intermediaries between farmers and consumers is harmful for the agricultural sector by damping famers' incentives to invest. This argument is based on the studies of Huang and Sexton (1996) and Alston et al. (1997). These studies show that intermediaries with market power can capture a large share of the benefits from the supply shift induced by farm sector research or adoption of new technology. Furthermore, Sexton (2012) extends the analysis to consumer and producer surplus by showing graphically that the presence of retailers/intermediaries who have market power generate concomitant reductions in both consumer and producer surplus. Market intermediaries can thus capture large shares of the benefits from policies intended to benefit farmers. It is therefore necessary to introduce a regulatory policy (e.g. setting a minimum price) with the objective of

improving welfare of small scaled actors. Russo et al. (2011), showed that setting a minimum agricultural price constrains buyers from exercising their market power in an oligopsony situation.

De Loecker and Eeckhout (2017) in their study about macroeconomic implications of the rise of market power affirm that:

> "*The presence of market power has implications for welfare and resource allocation. Firms that can command a price above marginal cost produce less output. In addition to lowering consumer welfare, this has implications for factor demand, for the distribution of economic rents, and for business dynamics such as entry and exit, and resource allocation*." (p.2)

However, some studies (Kirsten and Sartorius, 2002; Minten et al, 2007; Swinnen and Vandeplas, 2010) shown that farmers can take advantage in the rents sharing through contract enforcement. Contract is a way for small farmers in developing countries precisely in Africa to integrate export markets and generate more income. This is making it possible by providing new technology and secured inputs and prices (Kirsten and Sartorius, 2002). The distribution of rents in supply chain in developing countries are mostly linked to factors market constraints and weak institutions to enforce formal contracts between agents. Swinnen and Vandeplas (2010) argue that farmers are engaging in complex contracts with buyers. The contracts define not only the quantity and quality of the products to be delivered by the farmers, but also the supply of inputs, credits...by the buyers. These contracts according to Swinnen and Vandeplas (2010) lead to improve the welfare of both buyers and famers through improvement of quality of products. The question arising from this situation is who really benefits from this improvement in the well-being of the agents involved: one or both?
Swinnen and Vandeplas (2010) try to respond to the question by studying the impact of concentration in global food chains on efficiency and rents distribution. For this they develop a model which explicitly considers market imperfections and contract enforcement problems in supply chains. As results, they find complex interactions between concentration and rents distribution which can be resumed as follow:

> "*The growth of global food chains affects farmers in developing countries by increasing market opportunities for them. Moreover, in the presence of market imperfections and contract enforcement problems, efficiency premiums in vertically coordinated contract arrangements may provide additional benefits for farmers. Increased competition is likely to benefit farms by improving contract conditions but may hurt them as contract enforcement becomes more complicated. The empirical literature provides substantial evidence that contract terms indeed improve with more competition, but also that input and credit*

programs have collapsed because of (too much) competition and opportunistic behavior by farmers." (p.10)

This is consistent with Minten et al (2007) who show that smallholder vegetable producers in Madagascar benefit from trade despite selling products to monopolistic export companies. This has been possible through improvements in productivity, product quality, soil fertility and environmental protection. So, we can see that, restructuration of agricultural export markets leads to some market power which could have both negative and positive effects on rent sharing for famers.

3- Estimating the market power

Based on how companies compete White (2012) defines a method for measuring the market power. Its analysis is based on the competitive market assumption and defines the market power as the ability for a firm to have discretion over the price that it charges. Under this perfect competition, any producer should sell its production at a price equal to its marginal cost. This implies not having any market power. In other word, market power is the difference between sell's price and marginal cost, relative to sell's price and called "Lener index". Mathematically, the market power indicator represented by the "Lener index" is:

$$L = \frac{P - MC}{P} \ (1),$$

with L = Indicator of market power, P = price and MC = marginal cost

When L >/< 0 we have an imperfect market (the agents have a certain level of power).

But in real world, markets are not competitive. This situation is described by Robinson (1933) and Chamberlin (1933) as "imperfect competition" and "monopolistic competition" respectively. They find that the equilibrium is achieved with an easy entry on the market of firms which has close characteristics. And at the equilibrium we have the following expression (2) which implies that there is always market power. Indeed, the price set is different from the marginal cost.

$$P = AC > MC \ (2),$$

with P = price, AC = average cost and MC = marginal cost

The implementation of the Lener index expression provided by White (2012), is not easy to measure market power. First, the market power is computed in terms of profit rate and marginal costs are not directly observable in the data. Second, White based his work on the so-called demand approach which needs to have a detailed micro-level data on products, prices, consumers, and firms.

In contrast, for De Loecker and Warzynski (2012) market power is typically measured by the markup. The approach adopted by De Loecker and Warzynski (2012) is the so-called production approach as opposed to the demand approach. The demand approach estimates markup based on profit maximisation and requires a knowledge of marginal costs and data on demand (in terms of price, quantity, consumer characteristics, etc.), which is almost impossible to obtain. The so-called production approach does not require demand modelling and is based instead on producer income data. In addition, the cost minimisation method makes it possible to assess the change in the markup due to the change in inputs involving the technology used.

In their study to examine how the change in the environment of the firm could affect the markup (through the relationship between markups and export behaviour), De Loecker and Warzynski (2012) give a method to estimate markup using panel production data from Slovenian firms over the period 1994-2000. Based on the microeconomic equation of minimisation of production costs, they derive the following expression of the markup

$$\mu = \frac{\theta^X}{\alpha^X} \qquad (3),$$

with μ = the markup; θ^X= the output elasticity of variable input X and α^X= the share of expenditures on variable input X in total sales.
Using the production functions with a scalar Hicks-neutral productivity term and with common technology parameters across the set of producers, they derive the output elasticity of variable inputs. They find that:

> "*markups differ dramatically between exporters and non-exporters and are both statistically and economically significantly higher for exporting firms.*" (p.5)

Thus, markup depend on the characteristics of firms. Indeed, De Loecker and Warzynski (2012) show that these differences in markup between exporters and non-exporters would be explained by the quality of the products and the better productivity of the exporters. The most productive firms are those that have an easier ability to penetrate the export market and earn more margin from the market. The weakness of this method is that the estimated markup can be affected. However, this in no way affects the correlation between the markup and the characteristics of the firm.

Using the same so-called production approach as De Loecker and Warzynski (2012), De Loecker and Eeckhout (2017) highlight the difference between markup and the profit margin in their study of the macroeconomic implications of market provisioning. This study focuses on the evolution of the markups of publicly traded firms covering all sectors of the US economy from 1950 to 2014 to illustrate the effects of market power on the US economy. Using an industry-specific Cobb-Douglas production function they

derive the same expression of markup (expression 3) as De Loecker and Warzynski (2012). And present markup as proxy of market power and stressed that an increase in the markup does not always imply market power if profit rate is used as indicator of market power as in White (2012). De Loecker and Eeckhout (2017) try to explain their idea as follows:

> "*Markups tell us that the margin of revenue over variable costs has increased. That does not necessarily imply that firms are making higher profits. If for example the source of the increase in markups is technological change that reduces variable costs, and the same technological change increases the fixed costs. […] As a result, profits will continue to be low and higher markups do not imply higher market power*."

Through a response note to the criticisms received on the 2017 article, De Loecker and Eeckhout (2018) emphasize this difference to show that markup gives more information than the profit rate. The markup allows to identify the role of technology (through variable costs) in market power.

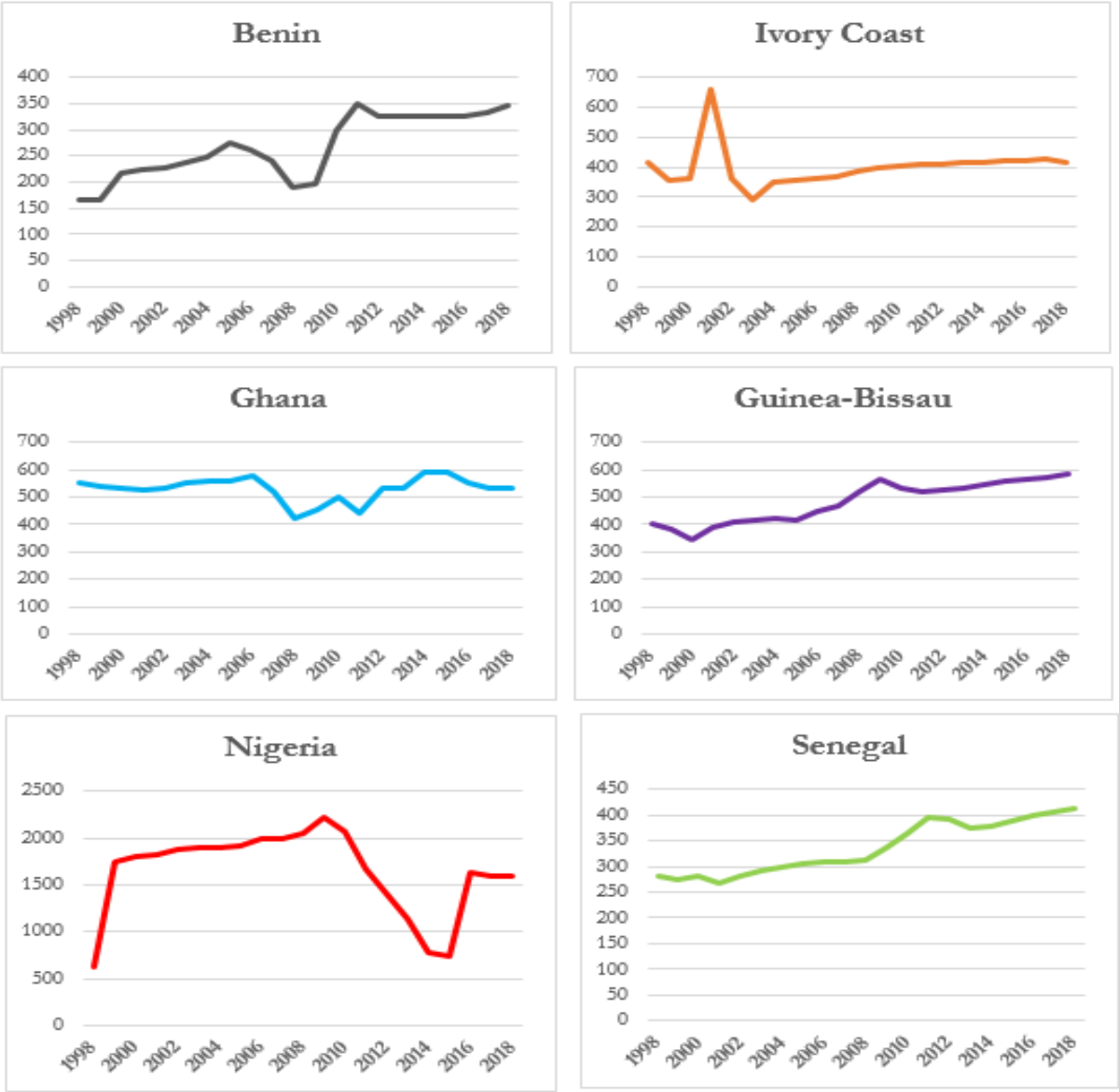
III- BACKGROUND ON THE CASHEW SECTOR IN BENIN

The cashew tree is a crop native from South America that was introduced in Benin in the 17th century as a pleasure plant and to fix the dunes. Cashew were planted in the 1960s for reforestation purpose by the public administration (state water and forestry services) before being bequeathed, in 1976, to local communities due to management constraints (Aïvodji and Anasside, 2009; Soglo and Assogba, 2009). It was during the period 1976-1990, that the cashew nut served as a fruit tree providing income opportunities for the planters (Aïvodji and Anasside, 2009).

The sector developed rapidly from the 1990s onwards. Tandjiekpon (2010) cites as reasons for this importance the rise in the purchase price of nuts on the international market, the need for diversification following the difficulties of cotton and the devaluation of the CFA franc, making local production more competitive.

From 1990 onwards, the area under cultivation, about 10,000 ha, increased rapidly (Lacroix, 2003) to be estimated at about 200,000 ha in 2017 (MAEP, 2017). However, the sector records low yields in the order of 150 to 350 kg/ha of raw nuts (MAEP, 2017). Compared to other West African countries, Benin has the lowest yield over the two decades from 1998 to 2018, as shown in graph 1 below. According to the MAEP (2017), the government projected an increase in these yields to reach the target of 600 kg/ha in 2021.

Graph 1: *Cashew nuts yield in West Africa (kg/ha) in the period 1998-2018*



Source: *by author based on FAO data from http://www.fao.org/faostat/en/#data/QC*

The low yields could be attributed to poor cultivation practices, lack of seed and plantation maintenance (Tandjiekpon, 2010; MAEP, 2017). In addition to these arguments, Soglo and Assogba (2009) point out the lack of financing and the fact that there is no quality requirement when the government sets minimum prices, as causes of the low returns observed. Despite the low yields noted in the sector, cashew nuts constitute one of the country's main sources of income. Indeed, the cashew sector is currently Benin's second largest source of export revenue, accounting for about 15.66% of the value of exports, with an estimated 200,000 producers (INSAE, 2019). In addition, the quantity of cashew nuts exported increased significantly - by 156% - from 2011 to 2015 (MAEP, 2017). Benin has a comparative advantage in cashew nut

production, which is highly recognized on the international market a KOR[1] between 47 and 52 libs. As a result of this advantage, Benin ranks eighth in the world in cashew nut production in terms of quantity (Akomagni, 2017). This importance leads the state to regulate the sector by setting a floor price for cashew nuts for each marketing year.

Setting a minimum price is a mechanism that has existed since colonial times in African colonies (including Benin). It is used to reduce the impact of the volatility of world prices of tropical export products and would also allow producers to cover the variable costs of production. Soglo and Assogba (2009) point out the problem of storage as a constraint for the sector. They argue that farmers do not master/respect storage techniques. The government, with the aim of boosting the sector, has implemented several reforms. In 2000, the sector was instituted as a value chain with a pricing mechanism bringing together the different actors (Lacroix, 2003). The purchase price of cashew nuts is set by the government after negotiations with producers, buyers, exporters and state structures. Tandjiekpon (2010) reports that the fixed price is never applied, the sale being made at a price 25% below the minimum price. In fact, producers often sign pre-harvest agreements with buyers. These contracts help farmers to receive credits (in the form of advance) to deal with production (paying for inputs and labour) and social problems (Soglo and Assogba, 2009; Swinnen et al., 2013). Also, the weak sales organization combined with the few number of buyers allow buyers to act as price makers (Soglo and Assogba, 2009; Tandjiekpon, 2010).

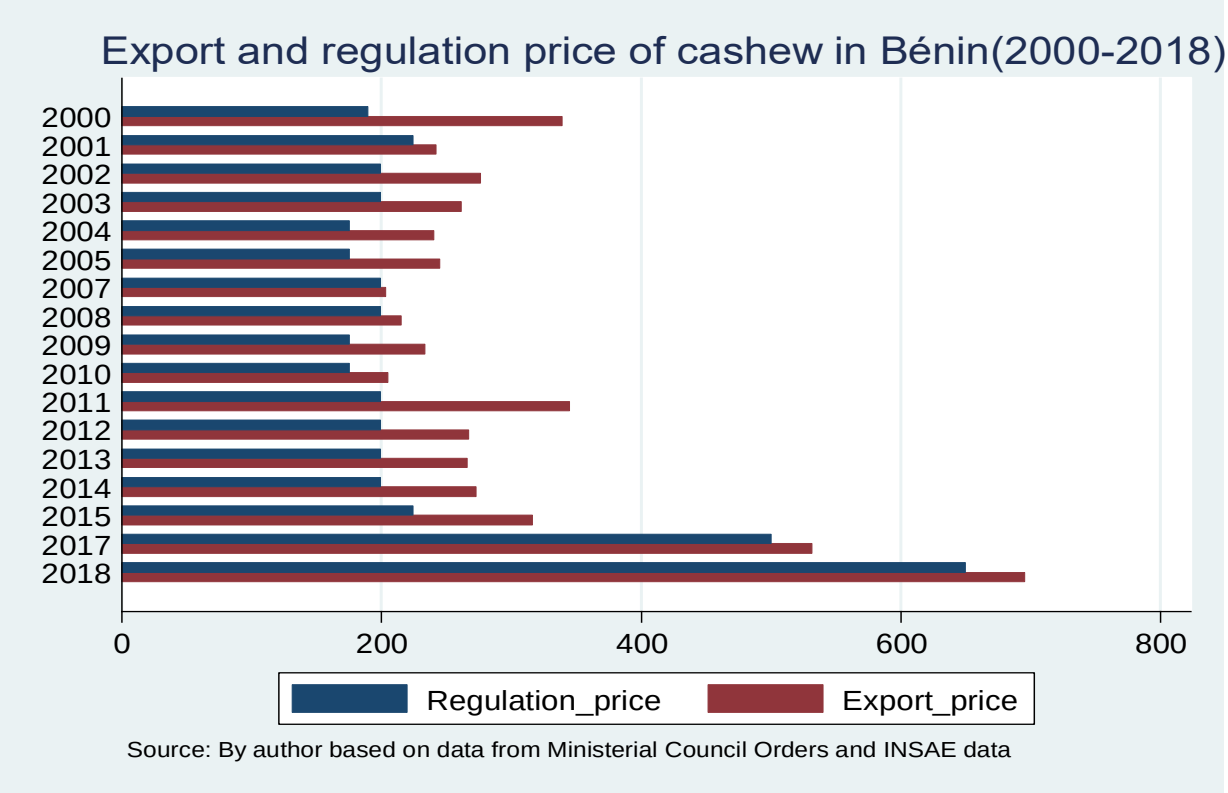
With the same objective of boosting the value chain, an inter-professional organisation for the cashew sector (IFA) was created in June 2016. The IFA is responsible for proposing a minimum price for raw cashew nuts each year, but it is the government that finally decides on this price in the Council of Ministers after analysing the initial IFA proposal and taking into account other considerations. The government's pricing mechanism for each season is not based on a clear methodology. There is no evidence that it incorporates data for each stage of the production chain (MAEP, 2017). This could prevent producers from benefiting from their activities because they do not obtain income favourable to the expansion of their activities. As a result, they will not be able to acquire better production technologies in order to reduce the production cost and to benefit more from their activity.

Through graph 2, we observe the evolution between the minimum prices fixed by the government and the export prices per kilogram in 2000-2018. Over the entire period, the export price remains well above the minimum price. Intermediaries seem to be those

[1] The KOR (Kernel Output Ratio) measures the quality of cashew. It is measured in lbs quality in terms of one bag of 80 kg of raw cashew nuts. An excellent out turn is 48 – 55 lbs. A good out-turn is 43 – 48 lbs. Less than 43 lbs is a poor grade and is usually rejected. (Tandjiekpon, 2010)

who benefit from the chain since the producers already sell at a price below the minimum set as shown later on graphs 3, 4 and 5. This confirms Sexton (2012) who finds that intermediaries are harmful to the agricultural sector. But the differences observed between export and producer prices could be explained by transport and storage costs and taxes paid by exporters as well as production cost of processors.

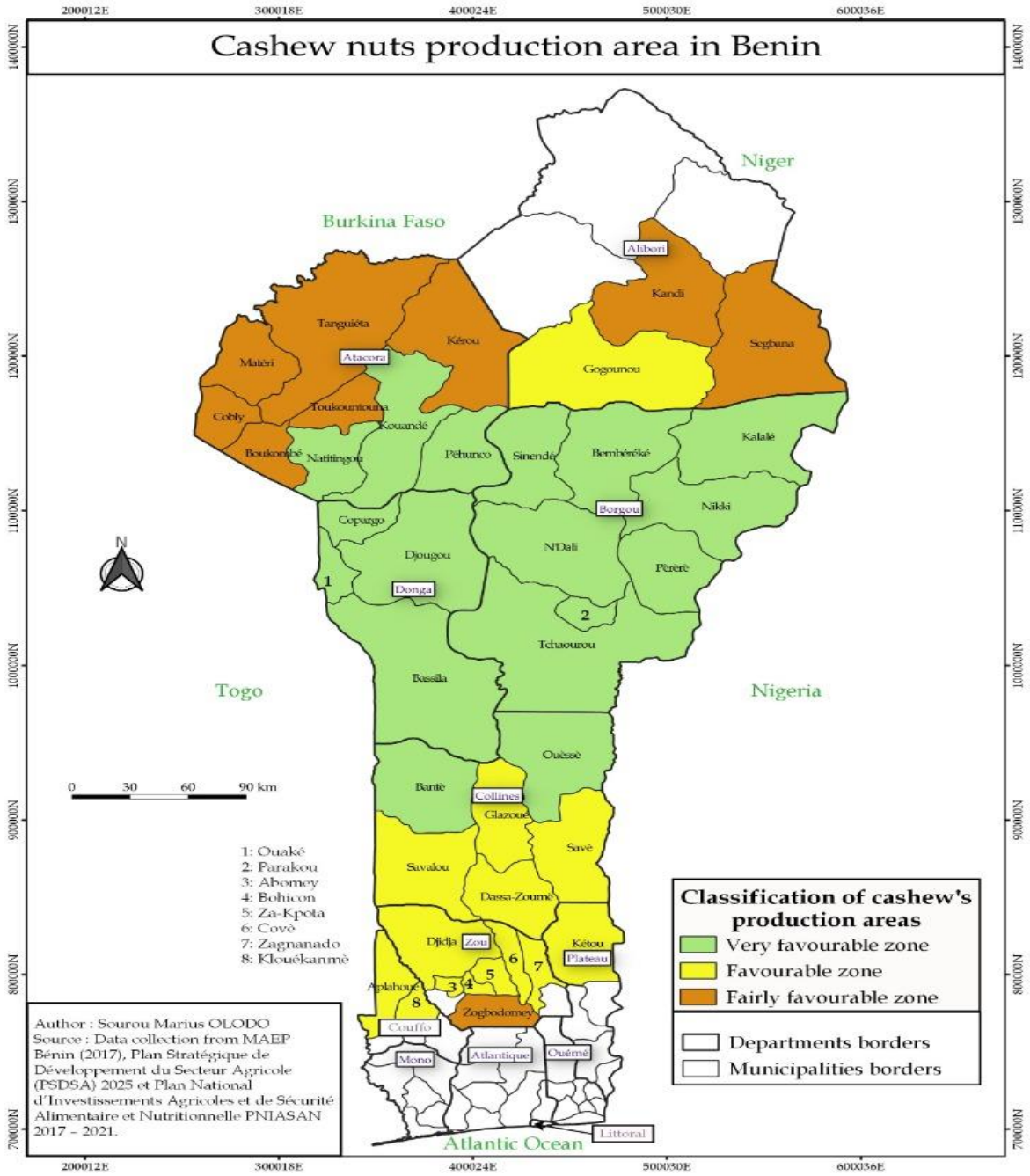
Graph 2: *Evolution of the export price and the regulation price of cashew nuts from 2000 to 2018*



So, it is important to support producers to facilitate access to new technologies and increase their bargaining power. In fact, producers are pre financed by buyers to access inputs, labor and technical assistances (Swinnen and al., 2013; Tandjiekpon, 2010) before the marketing period; which limits their bargaining power. An improvement in the producers' share of cashew nut marketing revenues could have a positive effect on household welfare in terms of income by the value chain.

Cashew nuts are cultivated in several communes of Benin classified in three zones by MAEP (2017). The very favourable zone composed of 17 communes and represent 87% of the plantations in Benin, the favourable zone concerns 14 communes and includes 11% of the plantations and the fairly favourable zone composed of 09 communes has 2% of the plantations. Figure 1 below shows the different zones.

Figure 1: *Cashew nuts production area in Benin*



Benin has generally three production seasons: a great rainy season (form March to June), a little rainy season (from July to October) and a dry season (from November to February). But the north of the country which includes the region studied (Atacora-Donga) is characterized by two main production seasons: a rainy season (from March to August) and a dry season (from September to February). Cashew marketing officially begins in March and continues until September. And sales reach their peak during the month of May. Harvests already start during the dry season from December to reach their peak in February and last until April (the period December-February is called pre-

campaign). It should be noted that some producers do not await the beginning of the marketing period to sell their products and a significant part of the trade is outside official control. Akomagni (2017) reports that:

> "*The sale of nuts is done in houses, roadsides, in buyers' shops or those of producer groups. Markets are organized spontaneously according to the actors (producers, traders, exporters). They take place outside the formal market places and days. Home selling is the dominant mode (statistics from our survey). The advantage of this sales mode is that it allows producers to limit the transport costs linked to the marketing of the product*." (p.36)

Akomagni (2017), explains this fact by the financial difficulties faced by producers.

The main actors interacting to purchase the products harvested during marketing process are highlighted in the figure 2 below. We have:

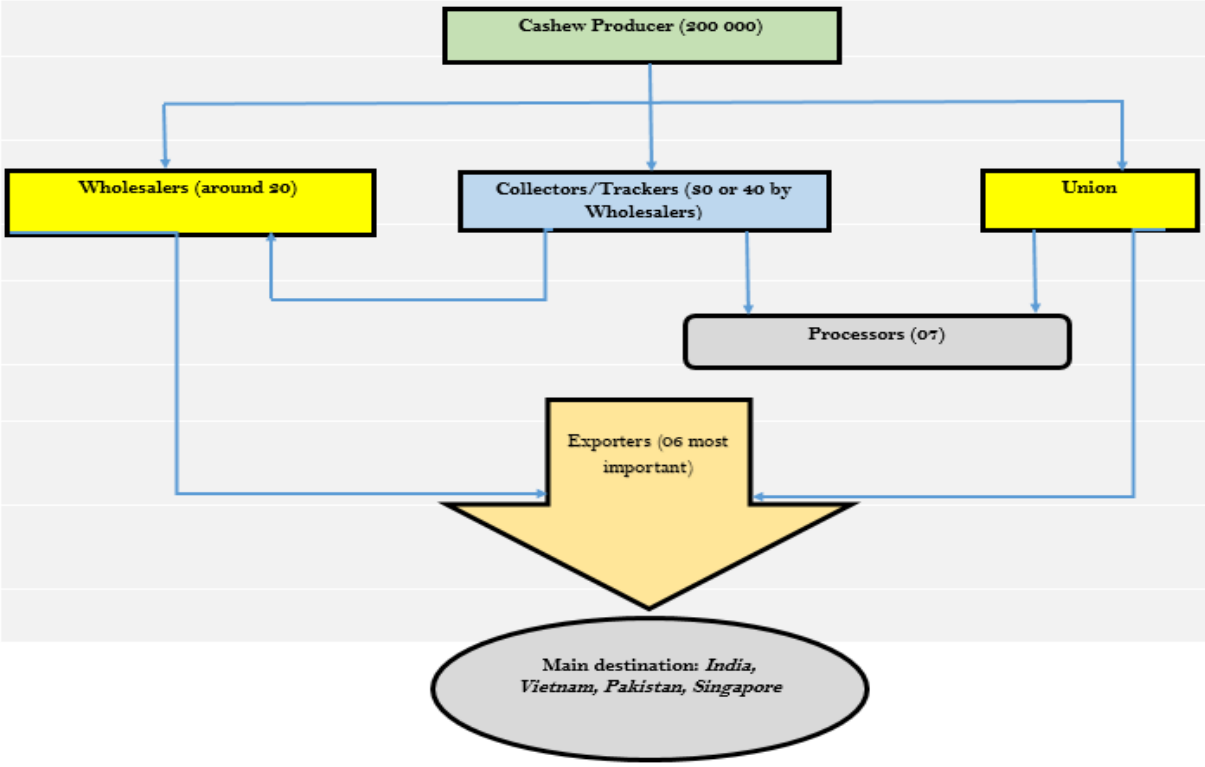
i) **Collectors** (also call locally pisteur/demarcheur/revendeur**):** more informal, they live in the production areas and have an excellent geographical knowledge of the production sites. They have the possibility to work for several wholesalers who provide them with working capital. However, they can also operate with their own funds, which gives them the opportunity to sell to processors for instance. We assume here that they correspond to the local market. By local market, we mean the case where the producer cannot identify the true buyer because he has sold the cashew either at home or at a market without any planning.

ii) **Wholesalers:** generally formalized, they correspond in our study to national and foreign private buyers, they have a contractual relationship with exporters and operate in the field with the help of collectors. There are about twenty wholesalers on the marketing system and each wholesaler may have between 30 and 40 collectors in its network. A wholesaler can buy directly from producers through its field agents. They would benefit from campaign credits from the exporters. Some of them, however, start purchasing with their own funds, which allows them to have some independence and sell the products to the exporter with the highest offer.

iii) **Farmers' Union:** they are also wholesalers/semi-wholesalers but with the difference that they buy directly from producers. So, in addition to selling to exporters and wholesalers they also sell to processing units.

iv) **Exporters:** they are generally formalized with documents proving their exporter status. We have few exporters on the market (around 06), they buy the nuts from wholesalers.

Figure 2: Actors interacting during cashew nut marketing process in Benin



Source: by author with aggregating informations form: Akomagni (2017), MAEP (2017), Soglo and Assogba (2009) and Tandjiekpon (2010)

In summary, despite the evolution and the importance of cashew nuts in Benin, this sector is characterized by a low production yield due to the lack of mastery of production techniques, the lack of maintenance of plantations and the lack of seed and the storage techniques. Its development is also constrained by a weak price setting and enforcement mechanism, a low local processing rate and a strong dominance of intermediaries.

IV- METHODOLOGY

First, we present data used and descriptive statistics. Second, we present the model used to estimate markup and the determinants of market power (measured as markup).

1- Data

The data used are collected by the BeFinD-Academic Research Organisation for Policy Support (ACROPOLIS) in collaboration with the Belgian Development Agency (ENABEL) in the Atacora-Donga region in the framework of the PROFI's program (PROgramme d'appui aux FIlières agricoles).

In 2016 and 2017, ENABEL launched, respectively, two calls for micro-projects for production and marketing (MIC) whose target for intervention is the producers'

organization (PO). And three agricultural sectors were targeted (cashew nuts; rice; and vegetable products) to benefit from financial and non-financial support in the Mono-Couffo region in the south and Atacora-Donga in northern Benin. After this identification phase, POs submitted their MIC project ideas. ENABEL analysed them through a selection process in three successive and qualifying stages: pre-selection; field visits; and final selection of projects by a regional approval committee (CRA). Table 1 below summarizes the selection process for micro-projects in the cashew nut sector.

Table 1: *Number of cashew nut POs selected*

Cashew	CRA 1		CRA 2		Total
	Number of POs	%	Number of POs	%	
Application process	54		45		99
Selection process					
Pre-selection	48	89	35	78	83
Field visits	30	63	11	31	41
Final CRA	27	90	10	91	37
Financed	27	100	6	60	33

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

Data were collected on 5 producers in each of the POs selected during the CRA sessions (financed or not). The data covered 3 production seasons, which are:

- **rainy season of the 2018-2019 production campaign:** March 2018 to August 2018;
- **dry season of the 2018-2019 production campaign:** September 2018 to February 2019;
- **rainy season of the 2019-2020 production campaign:** March 2019 to August 2019.

A total of 215 cashew nut producers were initially scheduled to be interviewed. But during the data collection, producers initially targeted in rice and vegetable POs were identified as cashew nut producers as well. This brought the number of cashew nut respondents to 261. Table 2 shows the distribution of producers over commune with Kouandé, Péhunco, Bassila, Djougou and Ouaké as the most represented. This makes sense as the most represented communes are classified among the very favourable zone for cashew nut production in contrast (MAEP, 2017)

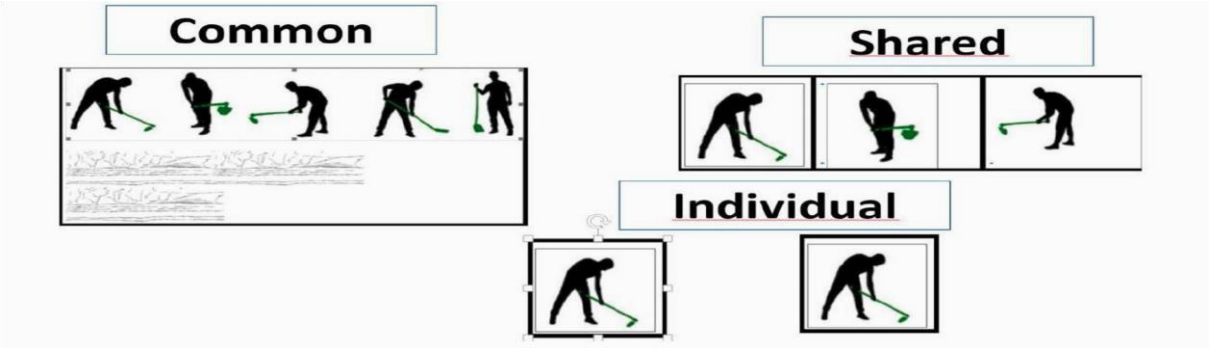
Table 2: Number of cashew nut producers by commune

Department	Commune	Freq.	Percent
Atacora	Kérou	15	5.75
	Kouandé	27	**10.34**
	Natitingou	3	1.15
	Péhunco	43	**16.48**
	Toucountouna	15	5.75
Donga	Bassila	38	**14.56**
	Copargo	20	7.66
	Djougou	64	**24.52**
	Ouaké	36	**13.79**
Total		261	100.00

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

The possibility was given to record data on the three most important plots belonging to each respondent. There are three possible modes of exploitation of a plot as illustrated in figure 3 below.

Figure 3: Agricultural plot types



Source: *Calderone et al. (2018)*

Common mode: The respondent uses the parcel directly together with all other members of the PO. All expenses and revenues are shared indiscriminately among the different members.

Shared mode: The plot is in bloc with those of the other members of the PO and each member has a part that is operated by his household (or team). Each member is responsible for his or her part of the land in terms of expenses and income even if some decisions can be made in common in the PO.

Individual mode: The plots are not in one block: each one has its plot clearly detached from those of the others. The respondent is completely autonomous in terms of decisions to be taken for production.

Table 3 shows how the plots of land used in the case of cashew nut are exploited. The individual farm type is the most dominant for cashew plots. This would be explained by the fact that on average 85% of the plots are obtained by inheritance (statistics from the study data).

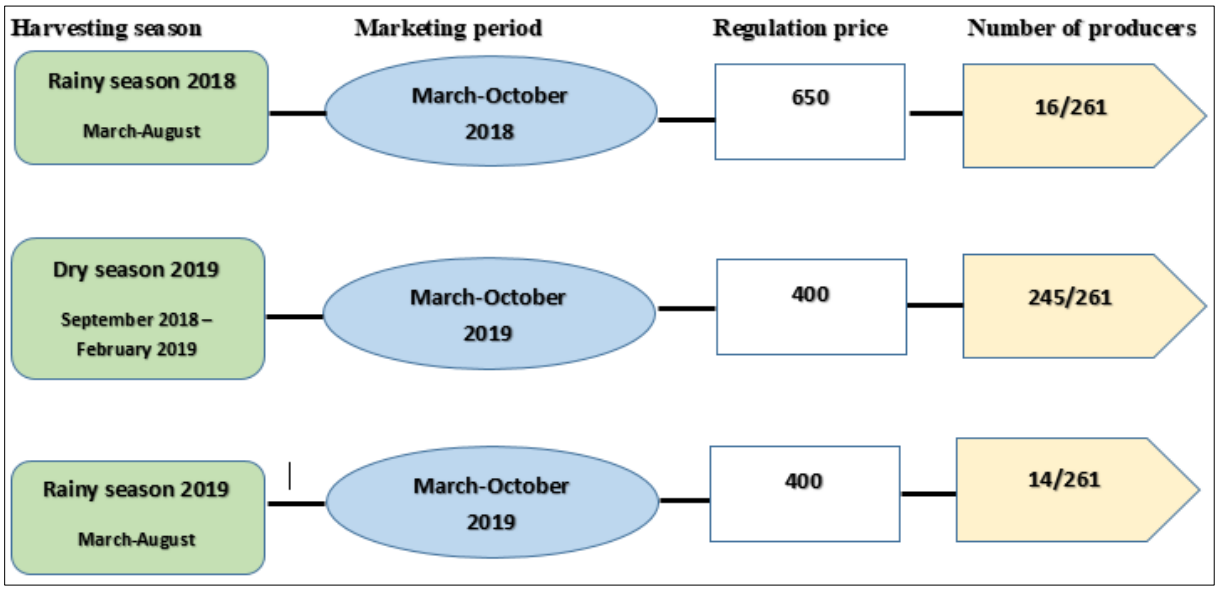
Table 3: *Distribution of mode of plot exploitation*

Type of plot	Plot 1		Plot 2		Plot 3	
	observation	%	observation	%	observation	%
Common	5	2.76	0	0	0	0
Shared	0	0	0	0	0	0
Individual	176	**97.24**	117	**100**	48	**100**

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

The figure 4 below shows the distribution of the producers for each harvesting season, and the regulation price for each marketing period. It should be noted that the most observed harvest period is the dry season, with 245 respondents compared to 16 in the 2018 rainy season and 14 in the 2019 rainy season. In fact, nuts mature at different times depending on the location (Evin, 2000). Most farmers are already harvesting during the dry season (between December and February), according to the communes. However, other farmers in other communes start harvesting nuts two or three months after the dry season.

Figure 4: *Distribution of producers over harvesting and marketing period*



Source: *by author based on Minister council order and ENABEL/ACROPOLIS-BeFinD data*

a- Production performance

Table 4 shows that the communes of Kerou, Kouandé, Péhunco, Bassila and Djougou are the largest in terms of exploited areas and production levels. These communes are

in the very favourable zone of production except for Kérou which is located in the fairy favourable zone (MAEP, 2017).

However, yield data show communes such as Toucountouna (427 kg/ha) and Copargo (484 kg/ha) as the most important, although not among the most important in terms of area and production level. They are followed by Kouandé (426 kg/ha) and Djougou (386 kg/ha). Except for the commune of Toucountouna, all are located in the very favourable production area. The location of the plot (the farming commune) is therefore expected to not have some effect on the respondents' performance. This will also be analyzed from the gain (margin) obtained from the sale of products in Table 8 later in this section. With the exception of Natitingou and Basilla, the yields obtained are well above the national average (303.51 kg/ha) observed over the decade 2008-2018 highlighted in graph 1 with data from the Food and Agriculture Organization of the United Nations (FAO).

Table 4: *Production by commune*

Department	Commune	Cultivated area		Quantity produced		Yield (Kg/Ha)
		Ha	%	Kg	%	
Atacora	Kérou	170	**15.18**	52768	**15.07**	340
	Kouandé	123	**10.98**	43601	**12.46**	**426**
	Natitingou	9	0.80	1200	0.34	238
	Péhunco	201	**17.95**	65213	**18.63**	343
	Toucountouna	67	5.98	22000	6.28	**427**
Donga	Bassila	222	**19.82**	48254	**13.78**	268
	Copargo	73	6.52	30695	8.77	**484**
	Djougou	206	**18.39**	72167	**20.62**	**386**
	Ouaké	49	4.38	14153	4.04	344
Total		**1120**	100	**350051**	100	

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

Because the way the decisions are taken in the PO could influence the performance of farmers, we build the table 5 based on the type of decision (individual or collective) in the PO. Three types of decisions have been considered here: the choice of crop to produce, the inputs to be purchased and the commercialisation of the agricultural production. The PO organization is considered as individual if the average score obtained for all 3 decisions is higher in terms of individual decisions than collective decisions.

For each of the 3 plots the individual type is the most dominant. However, for the plot submitted for funding for PROFI (plot 1), the collective organization is also important

(40. 17%). The individual mode is very characteristic of the cashew nut sector and this could be linked to the mode of acquisition of plots that are predominantly inherited. The importance of the collective organization observed for the plot submitted for financing can be explained by the requirements of the project. Indeed, the project was more oriented towards POs with a collective organisation.

Table 5: *Organization of production and commercialisation*

Plot type	Plot 1		Plot 2		Plot 3	
	Freq	Percent	Freq	Percent	Freq	Percent
Individual	137	59.83	214	95.96	148	98.01
Collective	92	40.17	9	4.04	3	1.99

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

Through Table 6, which relates the type of PO organization (individual or collective) to producer performance in terms of yield, one is tempted to say that there is no effect of PO organization on producer performance. Indeed, no trend emerges from the observation of average and median yields for each of the plots. However, the large variance observed suggests huge imprecision/heterogeneities.

Table 6: *Yield by type of PO organization*

	Yield (kg/ha)				
Type of PO organization	sd	min	mean	median	max
	Plot 1				
Individual	160.11	62.5	350.18	333.33	1000
Collective	207.24	20	310.05	267.33	1100
	Plot 2				
Individual	199.31	25	353.04	321.25	971.43
Collective	132.71	266.67	431.78	422	600
	Plot 3				
Individual	210.43	62.5	364.24	375	1000
Collective	.	.	.	.	.

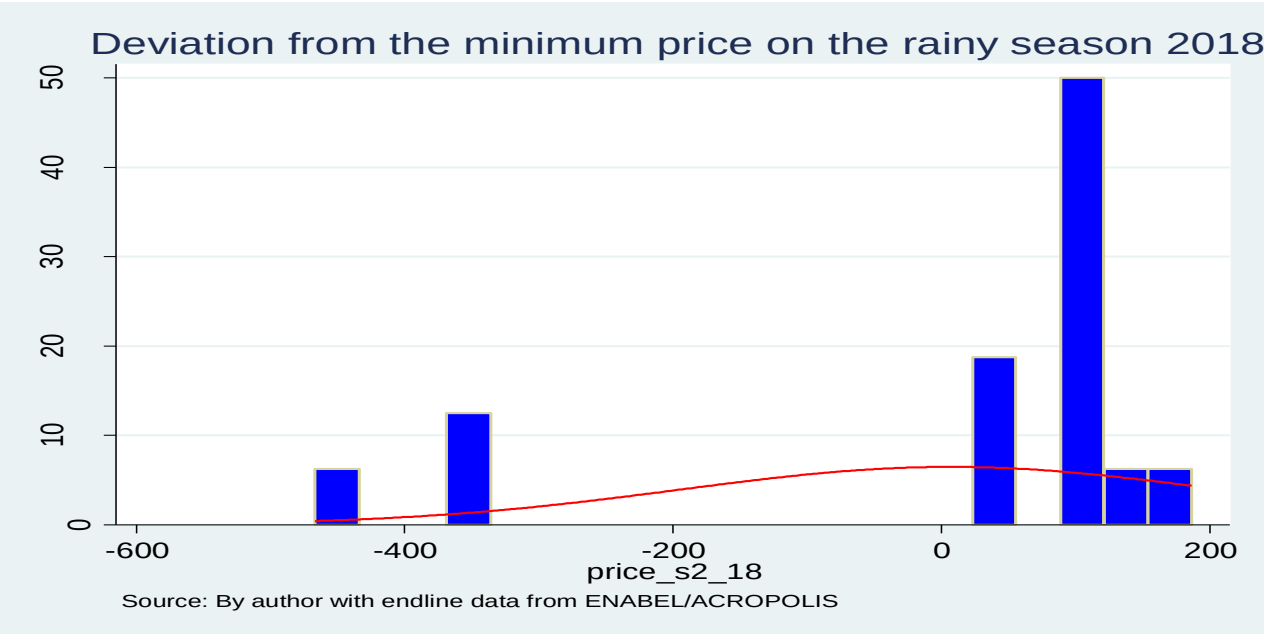
Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

b- Price, cost and margin from sales

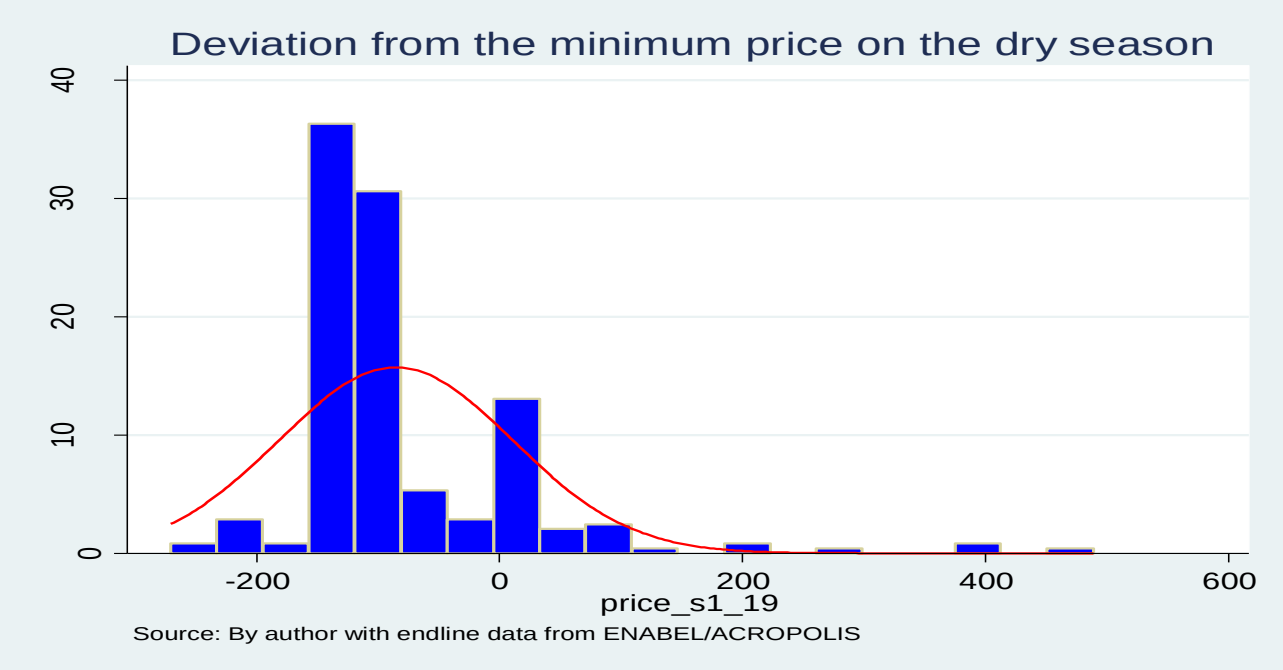
Graphs 3, 4 and 5 below highlight the proportion of respondents for whom cashew nut selling prices deviate from the minimum recommended by the government. It appears that about 82% of the respondents who harvested during the 2018 rainy season and participated in the 2018 marketing year sold their production at a price higher than the

indicated minimum of 650 CFAF (Graph 3). However, about 80% of those who harvested in the dry season (Graph 4) and 100% of those who harvested in the 2019 rainy season (Graph 5) to participate in the 2019 marketing year sold their production at a price below the minimum of 400 CFA francs. This information shows that the minimum price indicated by the government is not always the reference in the field. This weakens the welfare of producers who earn low incomes from their activities compared to the price of selling on the international market.

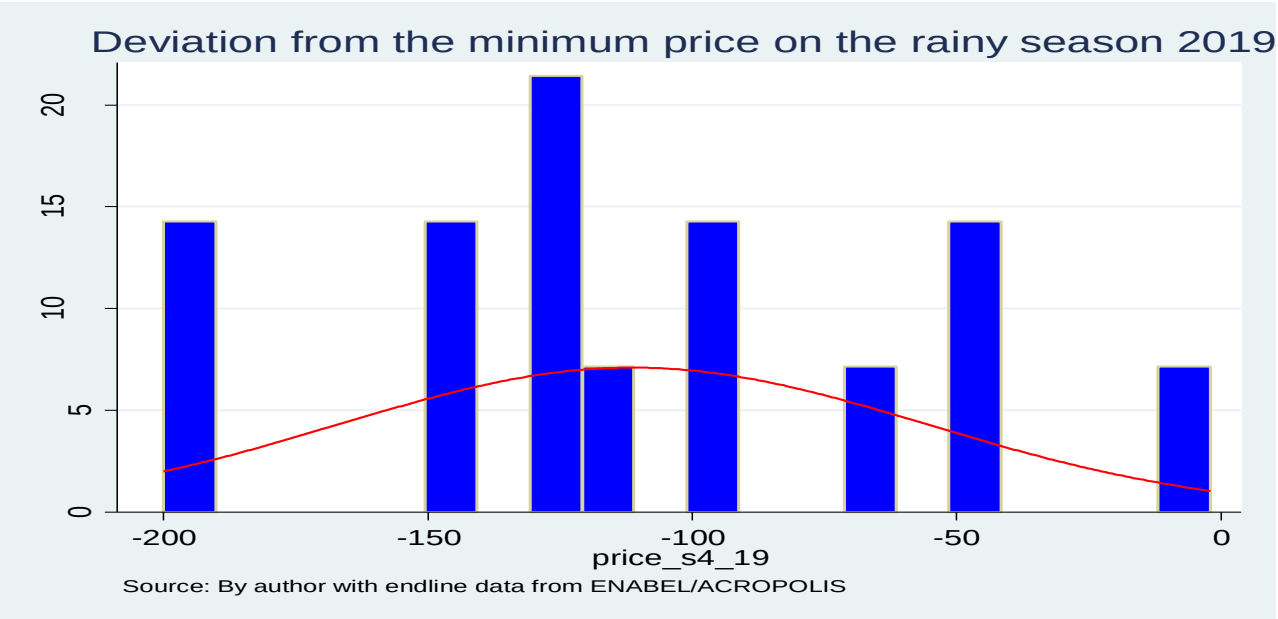
Graph 3: *Deviation from the 2018 regulation price for producers who harvested during the rainy season 2018*



Graph 4: *Deviation from the 2019 regulation price for producers who harvested during the dry season*



Graph 5: *Deviation from the 2019 regulation price for producers who harvested during the rainy season 2019*



Comparing the rainy period (2018 and 2019), it can be observed that the producers[2] earned higher revenues during the 2018 marketing year (where regulation price was 650

[2] It is the same producers between the two periods

F CFA) than during the 2019 sales year (where regulation price was 400 F CFA). This is confirmed when we consider the median parameters (selling price and quantity sold) in 2019 (1143 kg and 280.612 F CFA/kg) and in 2018 (673 kg and 750 FCFA/kg). Similarly, producers who harvested their produce in the dry season and participated in the 2019 sale also sold their produce at relatively low prices compared to those of the 2018 marketing year.

Table 7 below, gives the minimum and maximum marketing prices as well as the average and median prices by harvest season and marketing period. The results are consistent with the observations made in graphs 3, 4 and 5. Indeed, the average and median selling prices are higher for those who participated in the 2018 marketing year, during which the price set by the government was 650 F CFA, compared to the 2019 marketing year, when the price set was 400 F CFA.

Table 7: *Selling price and quantity sold over season*

Harvest season	Selling price (F CFA)			
	Minimum	Mean	Median	Maximum
Rainy season 2018	183.33	656.94	750	836.81
Dry season 2018	129.17	314.66	300	888.89
Rainy season 2019	200	288.74	280.61	398
Harvest season	**Quantity sold (kg)**			
	Minimum	Mean	Median	Maximum
Rainy season 2018	200	1559.44	673	4500
Dry season 2018	37	1153.34	800	6000
Rainy season 2019	300	1688.5	1143	4177

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

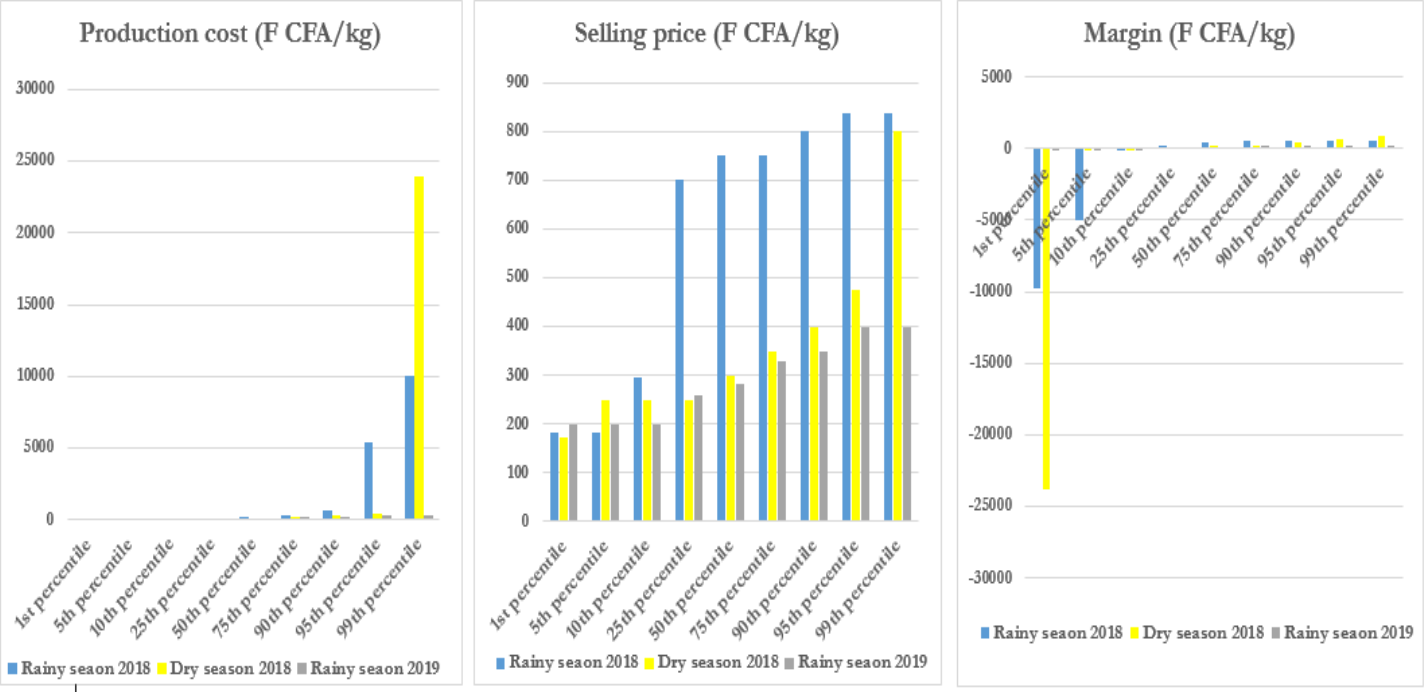
So even if, as shown in graphs 3, 4 and 5, the regulatory price set by the government is not systematically applied during sales, it could nevertheless be suspected that it has an effect on the prices applied during cashew nut sales operations. It could be interpreted as a signal from the government. Following an increase in the regulation price, the exchange price on the market would increase (and conversely for a decrease in the regulation price).

In general graph 6 shows that unit costs of production and unit margins/losses are relatively low and constant between the different producers observed regardless of the period of production. Those with very high unit costs of production are identified as those with the lowest margins so that the unit loss recorded is equal to the unit cost. These growers may have cashew seedlings on their plots so that they have not made a

sale. Although the unit margins observed are relatively consistent between producers, it also appears that half of the margins are negative. These observations would be explained by the conclusions drawn in Section III on the background of the cashew nut production chain in Benin. The sector is characterized by a lack of investment by producers. This has resulted in low production costs that affect yields and quality in a way that reduces possible margins.

What about the extent of the margin for those that are positive? Assuming cashew nut cultivation as the only source of income, could the representative producer satisfy his primary or subsistence needs? Even if the margin obtained from the sale is positive, it would not allow the representative producer (median) to be self-supporting. In fact, in the dry season, when we have the most harvest, the representative producer would obtain a margin of 177.300 F CFA francs per kg for a quantity sold of 800 kg (table 7), thus a total income of about 141,840 CFA francs for a year (around 394 FCFA/day or $0.739/day). This does not allow the smallholders to cross the poverty line of $1.90 per day (World Bank, 2016) defined for Benin. This supports the hypothesis that cashew nut producers are disadvantaged in the marketing of their products by the low profits they make.

Graph 6: *Distribution of Margin after sales, Selling price and Production cost*



Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

The observation in Table 8 showing the profit margins obtained by producers after sales supports the hypothesis of the non-existence of a "location effect" on producers' performance. Indeed, it can be seen that (considering the median margins) producers in

the communes of Kérou, Natitingou, Toucountouna, Copargo and Djougou had the highest profit margins. In particular, the producers in the commune of Natitingou are those who would record the highest margin (373 CFA francs as the median margin) despite the fact that they are not among the best performers both in terms of production level and yield. These differences in performance could then be attributed to a lack of mastery of production techniques and/or storage techniques, which would have effects in product quality and then reduce the profit margin depending on the commune. Also, the large margin intervals (minimum-maximum) and the high standard deviations allow us to conclude that producers are heterogeneous even within the communes. The individual characteristics of each producer could therefore have a considerable effect on the performance of the producers. Also being in a landlocked area by adding some additional costs (e.g. transport costs) for the buyer could play a role.

Table 8: *Margin*

Department	Commune	Margin after sales				
		Standard deviation	Minimum	Mean	Median	Maximum
Atacora	Kérou	126.89	-33.95	246.49	**293.52**	385.29
	Kouandé	957.02	-4841.59	-81.31	126.75	206
	Natitingou	230.13	101.29	344.38	**373**	558.86
	Péhunco	1911.91	-12358.91	-128.03	178.89	293.16
	Toucountouna	239.48	96	330.68	**281.51**	901.52
Donga	Bassila	13173.06	-70432.21	-2831.14	142.53	409.95
	Copargo	189.23	15.63	279.72	**241.32**	708.46
	Djougou	229.78	-184	276.55	**214.70**	835.20
	Ouaké	4125.45	-23825.2	-750	52.67	928

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

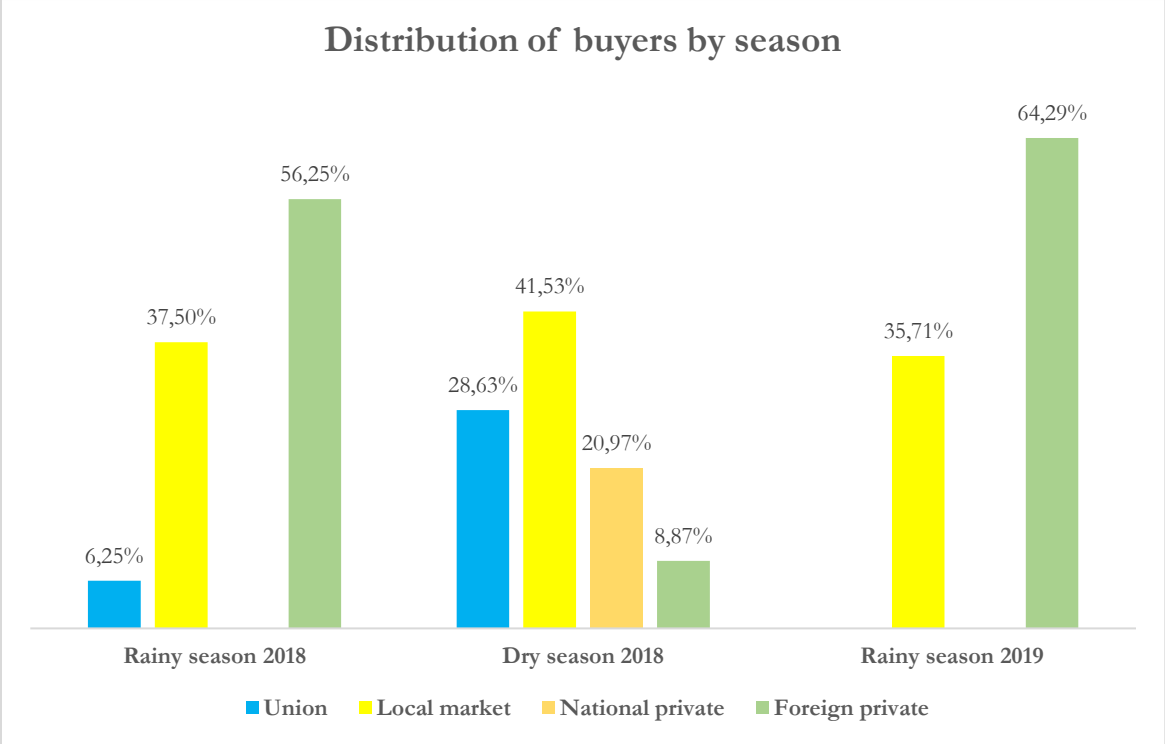
c- Margin and type of buyers

It is also important to analyse prices/margins according to the type of buyer who participated in the cashew marketing year. Graph 7 shows that the main buyers are foreign private operators and the local market for those who harvest their product on rainy season. But concerning the harvest in dry season, the main buyer's still local market, the national private operators and union. We can assume that foreign buyers concerned about complying with government decisions wait until the start of the marketing year before making purchases. However, domestic private operators and the union proceed earlier with the purchase/collection of cashew nuts.

The importance of selling on the local market could be interpreted by the financial fragility of the producers who would be obliged to sell the products often at low prices

to support certain household expenses. This would justify insufficient profit margins to meet primary needs as analysed in Table 7. It could also be understood because of the lack of supervision/organization of the cashew nut sector in Benin.

Graph 7: *Distribution of buyers by season*



Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

Table 9 shows that the margins obtained by the producers are positive (considering the median) regardless of the buyer (the main ones). However, the margin is slightly higher with a lower variance when the buyer is a private foreign operator compared to the other main buyers, i.e. the local market, private national operators and the union. This could be explained by the fact that foreign private operators are more respectful in government decisions waiting for the official marketing period (Graph 7) before buying the products by offering higher prices. It could also reflect that the quality of cashew involved is better. The type of buyer would then have an effect on the margin realized by cashew producers.

Table 9: Margin by type of buyers

Buyers	Margin					
	n	sd	Minimum	Mean	Median	Maximum
	Rainy season 2018					
Union	1	.	197.52	197.52	197.52	197.52
Local market	6	291.92	-204.54	371.58	467.09	568.44
Foreign private	9	166.52	102.24	424.4363	487.83	601.09
	Dry season 2018					
Union	71	147.32	-301.38	144.93	148.17	901.52
Local market	103	13921.91	-141051	-1153.12	181.95	743.53
National private	52	5848.70	-41988.39	-642.53	172.83	835.20
Foreign private	22	194.77	158.5	287.42	230.25	928
	Rainy season 2019					
Local market	5	84.13	-36.98	106.48	136.64	174.45
Foreign private	9	87.21	-64.95	99.08	100.16	244.29

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

d- Harvest and storage

In analysing the margins obtained in Table 10, we had assumed that a small margin could be associated with the lack of storage and production techniques. Concerning storage, it can be seen from Table 10 below that after harvest, on average, cashew nuts are stored for about 3 months before marketing. Some producers even store for 5 months. Maybe they store to speculate on the price. But the quality of the nuts and explicitly the market power of the producer could therefore be affected if the storage conditions are not respected. The relationship between the duration of pre-market storage and the profit margins obtained can be analysed further below. The question of the way cashew nut collection/marketing is organized in Benin also arises.

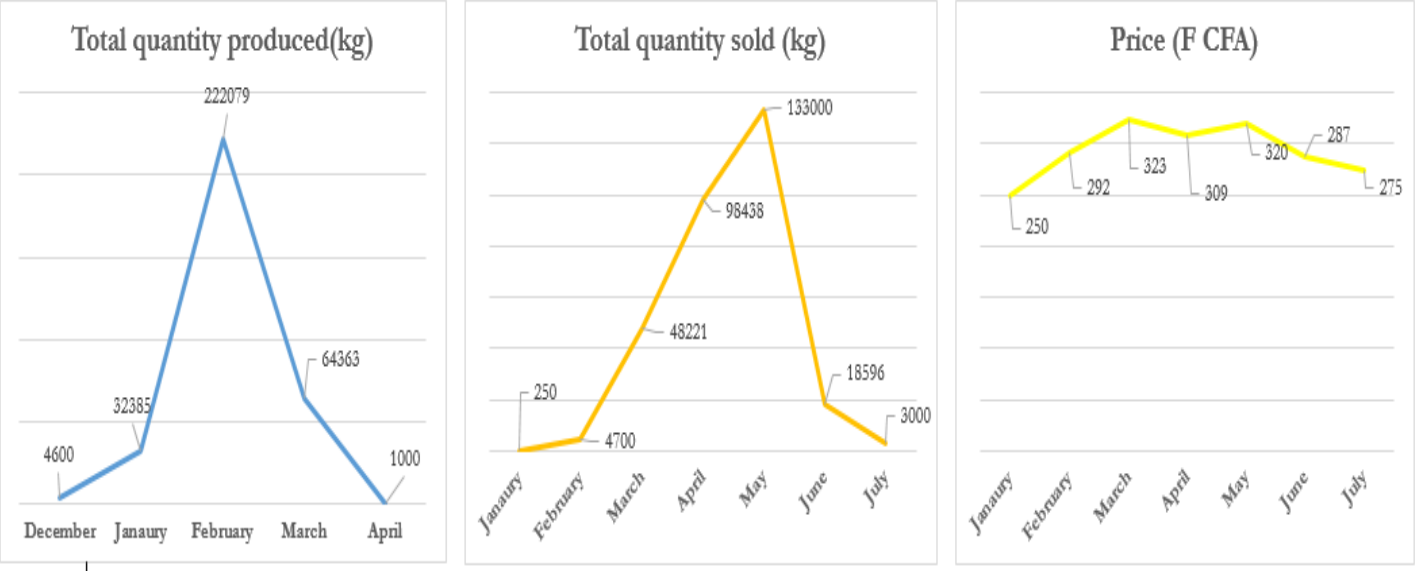
Table 10: Duration of harvesting and storage

Season	Duration of harvest (month)				
	sd	Minimum	Mean	Median	Maximum
Rainy seaon 2018	.60	2	2.4	2	4
Dry season 2018	.83	1	2.88	3	5
Rainy seaon 2019	.47	2	2.29	2	3
	Pre-sale storage time (month)				
Rainy seaon 2018	1.45	0	2.22	2.25	5
Dry season 2018	1.02	0	2.18	2	5
Rainy seaon 2019	1.07	0	2.71	3	4

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

Through graph 8, we analyse the evolution of the quantities of cashew nuts harvested, sold and the sale price over time. It appears that the producers who have the most quantity harvested are those who have started harvesting the nuts during the dry season (December to February). In fact, they are the most significant during this period. The quantity produced evolves from December to peak in February before decreasing until April. However, the sale begins between January and February to reach the maximum quantity in May, 3 months after the peak obtained for the harvest. This delay between these two peaks could negatively affect the market power of producers by deteriorating the quality of the products when storage conditions are not respected. However, the opposite can be observed through the analysis of the evolution of sales prices over time. Prices tend to increase over time, with a peak in June. This trend would be justified by the financial difficulties that lead producers to sell their production earlier and at low prices (Tandjiekpon, 2010). So, those who store for long time, would try to speculate and earn greater profit from their sales.

Graph 8: *Progression of harvested and sold quantity, and price over time*



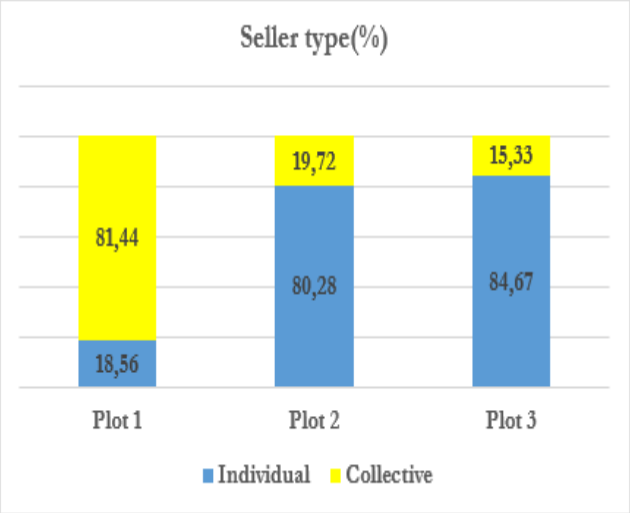
Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

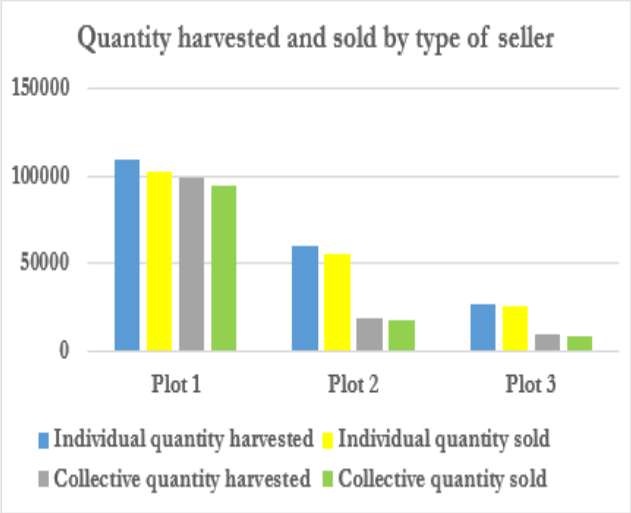
e- Sellers and buyers

The type of seller is defined from the marketing decision (individual or collective) in the PO. From graph 9 below, one observes that for the plots submitted for the project (plot 1), marketing is collective (81.44%), unlike the other plots (2 and 3) for which the marketing of products is individual. The type of sale could influence the market power of the producers. Indeed, collective selling through crop pooling would allow producers to have a strong bargaining power in the commercialization of cashew nuts. It should also be noted that the quantity sold which captures the capacity of the famers to access

market does not depend on the type of sale. Independently of the type of seller, the quantity harvested is almost totally sold.

Graph 9: *Type of seller and quantity harvested and sold*

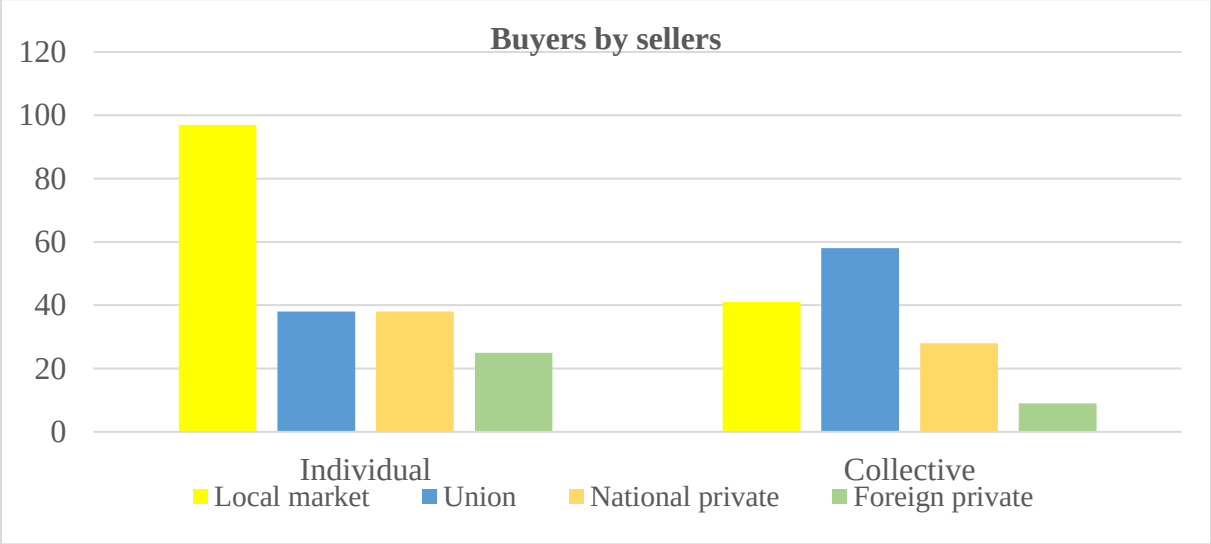




Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

The graph 10 highlights the main buyers according to the type of seller (individual or collective). Independently of the type of seller (individual or collective), the main buyers are the local market, the union and the national private operators. However, the union is the main buyer when the sale is made collectively by the producers of a PO. Indeed, producer's union implements the technique of grouped sales for the cooperatives/producers affiliated to it. This technique aims to control both the quality of the products exchanged and the prices offered to sellers by allowing producers to have better incomes. Individual sellers sell their products mainly on the local market.

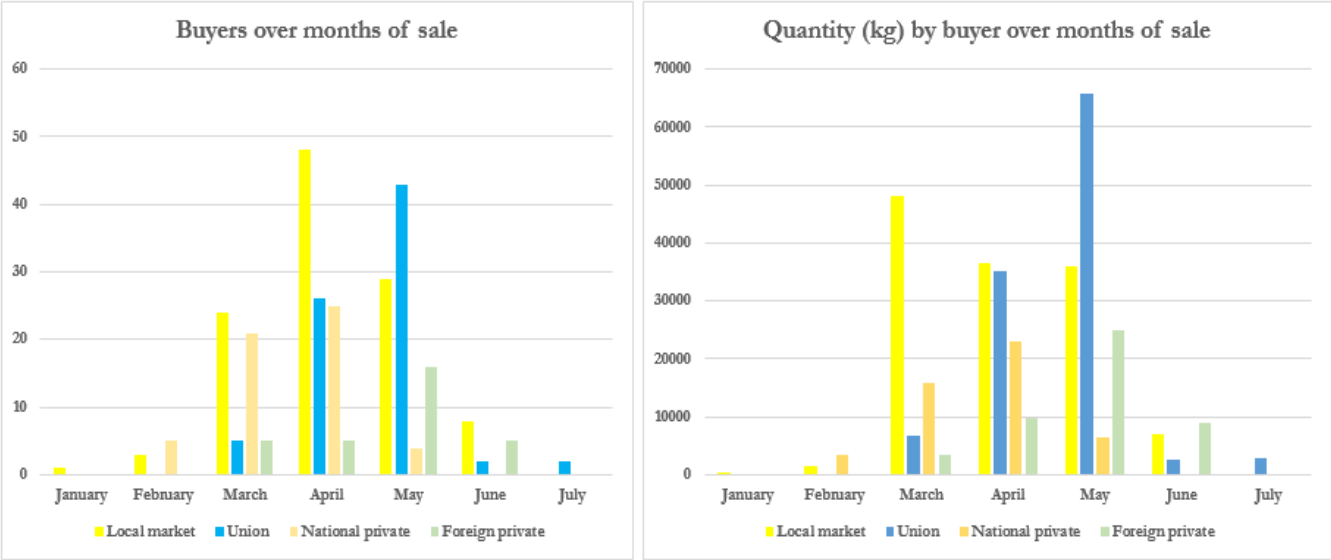
Graph 10: *Type of buyers by type of sellers*



Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

Graph 11 shows the distribution of buyers according to the months of sale and the quantities purchased by each type of buyer. In the months with the highest quantities sold (April and May), cashew nuts were sold mainly to the producers' union, to private domestic and foreign operators and on local markets. These buyers were also the ones who bought the largest share of the producers' sales. The quantity purchased could be a function of the market power of the buyer. The greater his market power, the greater the quantity of cashew nuts he can acquire in the purchasing transactions by controlling the value chain.

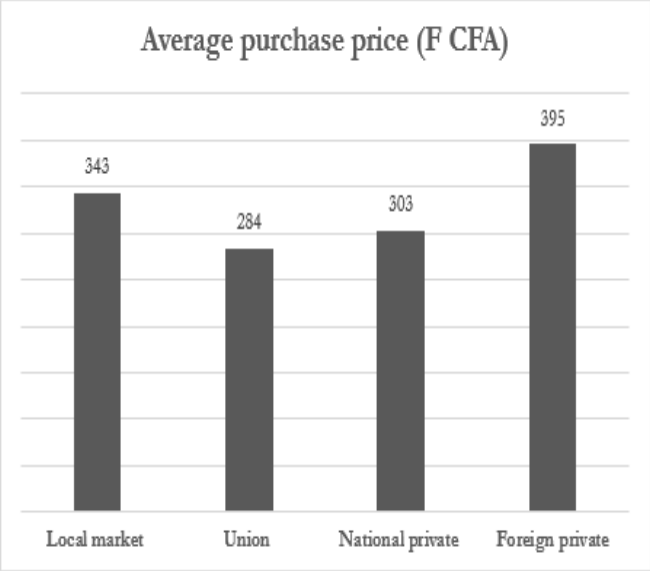
Graph 11: *Type of cashew buyers and quantity (kg) purchased in the selling months*

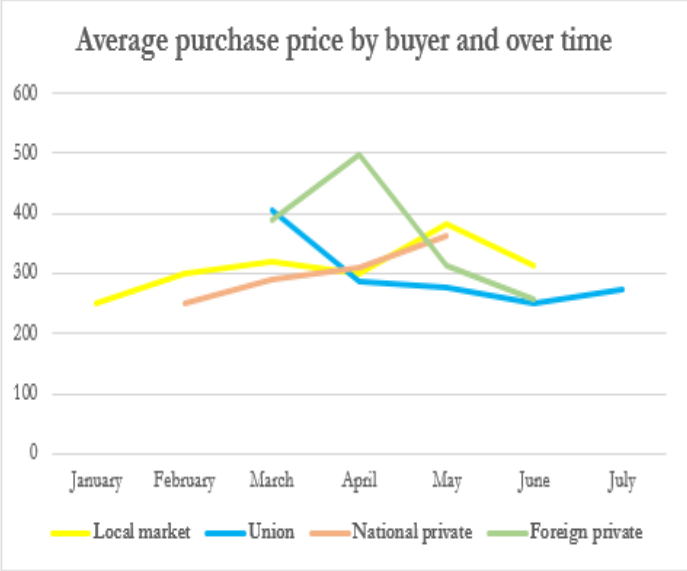


Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

It appears on graph 12 that foreign buyer's offers on average the highest purchase price, followed by the local market and national private buyers. Indeed, foreign operators involved in marketing would be more likely to respect the price set by the government and the purchase period indicated (graph 11). Also, contrary to the idea that producers sell their product on the local market at low prices to cope with financial difficulties, the local market offers on average higher prices than private operators and the union. We observe an increasing of the price offer by the local market and the national private operators which exhibit the lower price at the beginning of the period. They purchase the products at higher price in the time than the foreign private operators and the union which offered higher price at the beginning of the period.

Graph 12: *Average purchase price by buyer and over time*





Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

2- Model

The analysis of the determinants of the markup in this study will be done in three main steps. First, we follow the method developed in De Loecker and Eeckhout (2017) who used the Cobb-Douglas production function and derive the output elasticity of variable inputs. The Cobb-Douglas function is presented as a specific case of the Hicks-neutral production functions used by De Loecker and Warzynski (2012). It is not possible in this study to consider the productivity shock over time as in De Loecker and Eeckhout (2017) and De Loecker and Warzynski (2012). In fact, the data used here are not panel data (i.e. observed over one time). The analysis is done here at the plot level and we assume a common technology across farmers. This implies that output elasticities of inputs across farmers are constant in the case of Cobb-Douglas production function. Our Cobb-Douglas production function is rewritten by equation 4 below in which, variables are normalized by the size of harvested plot.

$$Q = f(V; F; P; W; S) = cV^{\theta}F^{\beta}P^{\gamma}W^{\delta}S^{\mu} \ (4),$$

with Q = normalized total value of produced cashew nut; V= normalized total value of variable inputs used; F= normalized total value of fixed inputs used; P= set of farmer's characteristics (Log of the years of experience, Educated, Received training on production, PO is financed by the project); W= set of workers characteristics defined as the sex of dominant workers, logarithm of family and non-family labour market; S= seed and plot characteristics (Seed quality, Number of years the plot has been in use and existence of right to use the plot); and c the production technology.

To get the estimation coefficients directly in terms of elasticity, we apply the logarithm transformation to equation 4. The result is equation 5 below, which is estimated using an OLS regression. So, the elasticities are obtained at the crop (industry) level.

$$ln\,(Q) = \alpha_0 + \theta \ln(V) + \beta \ln(F) + \gamma \ln(P) + \delta \ln(W) + \mu \ln(S) + \varepsilon \quad (5)$$

The coefficients/set of coefficients $\theta, \beta, \gamma, \delta, \mu$ represent the elasticities of the output to each corresponding variables/set of variables. Second, we measure market power by the markup based on the markup estimation method defined by De Loecker and Warzynski (2012). Based on the microeconomic equation of minimisation of production costs, this method derives the following markup expression.

Recall expression (3) $\mu = \frac{\theta^X}{\alpha^X}$,

where μ = the markup; θ^X= the output elasticity of variable input X and α^X= the share of expenditures on variable inputs X in total sales. The markup is estimated at the producer level by dividing the estimated elasticity by the share of expenditures on variable inputs X in total sales for each producer. And finally, we regress using a robust Ordinary Least Squared (OLS) the markup on the control variables in order to analyse the correlation between markup and the characteristics observed from cashew nut producers/buyers in the Atacora-Donga region in Benin. Table 11 below includes the variables used in the study.

Table 11: *Explanatory variables and expected effects on the markup*

Codes Explanatory Variables	Definition of variables
Production characteristics	
Production cost	
Variable inputs costs per ha	
Fixed inputs costs per ha	The markup is expected to increase with the increase of inputs expenses
Production value	
Value of the harvested quantity per ha	
Farmers and worker's characteristics	
Sex	
1 if woman; 0 if man	We expect more experienced and educated famers to produce more and have more market power and
Educated	

Codes Explanatory Variables	Definition of variables
1 if yes; 0 if not ***Years of experience in cashew***	
Seed and plot characteristics ***Seed quality*** 1 if improved seed; 0 if not ***Use of the plot*** Number of years the plot has been in use Having a right/prove to use the plot 1 if yes; 0 if not	The markup is expected to be influence positively by these factors
Selling characteristics ***Ratio Sales / Production*** ***Duration of storage***	This ratio gives the confrontation between supply (production) and demand (sales). More, it helps to capture the capacity of the farmer to access market. Increasing this ratio would imply an increase in the capacity of the producer to access market and meet the demand. Difference (in terms of month) between the harvest month and the sale month. This difference allows to measure the duration of storage before marketing. The intuition is that, if the producers do not master storage techniques, a long storage period could deteriorate the quality of the nuts and reduces the producers' market power. However, a long storage period could be seen as the way for the seller to speculate on the price and then have some market power.

Codes Explanatory Variables	Definition of variables
Type of seller 0 The sale is done individually. 1 The sale is done collectively.	We expected a positive effect on the markup assuming better organization and that the pooling of products would give producers greater bargaining power.
Month of sale 0 The sale is done before the marketing period. 1 The sale is done in the marketing period.	It assumed that producer who sell before the marketing period facing a financial problem, so have no bargaining power. This could have negative effect on the markup. Those selling during the marketing period are supposed to take advantage from the announcement of the regulation price sell at high price than the later.
Type of buyers ***Local market*** 0 Respondent does not sell to this buyer. 1 Respondent sell to this buyer. ***Famer's Union*** 0 Respondent does not sell to this buyer. 1 Respondent sell to this buyer. ***National private*** 0 Respondent does not sell to this buyer. 1 Respondent sell to this buyer. ***Foreign private*** 0 Respondent does not sell to this buyer. 1 Respondent sell to this buyer.	The different types of purchasers who bought the respondent's production. Intuitively, we expect a negative effect on the farmer's profit margin, regardless of the type of buyer. We assume here that the "local market" is dominated by the collectors. In fact, it captures the type of buyers when farmers do not know enough about the buyer who is buying their nuts. We know that the collectors are those who, most of the time, live in the production areas and have an excellent geographical knowledge of the production sites. And farmers do not necessarily know which wholesalers these collectors work with.
Finance and training ***Loan in process***	

Codes	Explanatory Variables	Definition of variables
0 1	No Yes	The respondent's situation in terms of a loan still to be repaid from any creditor. An existing credit would reduce the market power of the producer by imposing constraints on him that would lead him to sell his production without being rational.
	Training undertaken	
0 1	No Yes	Has the respondent received training on: Mastery of technical production methods, Economic performance and Techniques for the transformation of agricultural products? Having a training is supposed to positively influence level of production and also market power.
	PO financed	
0 1	No Yes	Has the PO to which the respondent is a member received financial support from Belgian Development Agency or not? Being a member of a PO that has received financial support could have a positive effect on market power by reducing constraints and facilitating training at producer level.

Source: *by author*

V- Empirical Results

1- Estimate a Cobb-Douglas production function

As indicated in the methodology above, we draw on De Loecker and Eeckhout (2017) and Loecker and Warzynski (2012) to analyse the correlation between markup and observed characteristics in cashew nut producers in the Atacora-Donga region of Benin. In a first step, we estimate a Cobb-Douglas production function in order to obtain the elasticity of the output with respect to variable inputs. Table 12[3] shows of the results. We can see that the variable inputs are the most significant inputs in cashew nut production in the Atacora-Donga region. An increase in the value of variable inputs by 1% increases the value of output by 0.68%. Fixed inputs have also positive effect on the production but are not statistically significant. These results would be explained by the fact that producers do not invest significant resources in terms of production technologies, mastery of production technique and plantation maintenance (Tandjiekpon, 2010). As shown by Houssa[4] et al (2018) for rice farmers in Benin, we find that the adoption of improved seeds contributes significantly to increased

[3] For more details see Annex 1. Only significant results are show here
[4] In a Befind 2018 working paper draft

production. The value of the output may be affected by the age of the trees, which is not considered in this study. As the plots are generally (about 85%) inherited according to the study data, it is assumed that the plantations are not necessarily renewed. This could explain why fixed inputs are not significant. The negative effect observed for farmers who have the right/proof to use the plot could also be justified by a correlation with the inherited characteristic of the plots. The results show no significant effect for individual farmer and worker characteristics for cashew nut production. controlling for plots fixed effects does not also influence the results.

***Table 12**: Estimation of a Cobb-Douglas production function*

Robust OLS results for Cobb-Douglas production function: regress logarithm of the value of production on the value of inputs (variables and fixed) and farmer's, seed, worker's and land characteristics

Dependent variable: Logarithm of the value production per ha	**(1)**	**(2)**
Robust standard errors in parentheses **** p<0.01; **p<0.05; *p<0.10*	coef./robust se	coef./robust se
Production characteristics		
Logarithm of value of variable inputs per ha	**0.686****	**0.685****
	(0.291)	(0.285)
Logarithm of value of fixed inputs per ha	0.027	0.024
	(0.044)	(0.048)
Seed and plot characteristics		
Seed quality (1 if improved seed; 0 if not)	**1.481****	**1.475****
	(0.627)	(0.663)
Having a right of use the plot (1 if yes; 0 if not)	**-0.714***	**-0.694***
	(0.399)	(0.401)
Plot effect	No	Yes
Nbr of Obs.	119	119
R-squared	0.410	0.411
F-stat	2.921	2.502

***Source:** by author with ENABEL/ACROPOLIS-BeFinD data*

2- The markup estimation and correlated factors

The second step in the analysis is to estimate the markup for each farmer by dividing the elasticity of the value of the output with respect to the value of the variable input by the share of the variable input in the farmer's sales income. The table 13 below presents the results of the regression of the markup on some observed characteristics which are

the farmer's characteristics, the production characteristics, the different type of buyer, the selling characteristics, the situation of famer about finance and training. For the analysis we focus on the sign and significance[5] of the coefficients.

Table 13: *Correlation between markup and the farmer's observed characteristics*

Robust OLS results for markup's determinants: regress logarithm of the markup on the production, farmers, finance and training, selling and buyer's characteristics

Dependent variable: Logarithm of markup	**(1)**	**(2)**
Robust standard errors in parentheses **** p<0.01; **p<0.05; *p<0.10*	coef./ robust se	coef./ robust se
Production characteristics		
Logarithm of value of variable inputs per ha	**-0.917*****	**-0.918*****
	(0.034)	(0.034)
Logarithm of value of fixed inputs per ha	**0.039****	**0.043****
	(0.019)	(0.021)
Farmer's characteristics		
Farmer's sex (1 if woman; 0 if man)	**0.300***	**0.305***
	(0.158)	(0.160)
Finance and training		
Outstanding loan (1 if yes; 0 if not)	**-0.766****	**-0.764****
	(0.389)	(0.387)
The PO of belonging was financed by the project (1 if yes; 0 if not)	**0.406***	**0.406****
	(0.208)	(0.206)
Selling characteristics		
Type of seller (1 if collectively; 0 if individual)	**-0.178***	**-0.176***
	(0.096)	(0.101)
Month of sale (1 if sold in the marketing period; 0 if not)	**0.399****	**0.392****
	(0.158)	(0.154)
Type of buyer		
Union (1 if sell to this buyer; 0 if not)	**-0.204***	**-0.202***
	(0.114)	(0.113)
Plot effect	No	Yes
Nbr of Obs.	280	280
R-squared	0.740	0.740
F-stat	60.166	53.050

Source: *by author with ENABEL/ACROPOLIS-BeFinD data*

[5] For more details see annex 2. Only significant results are show here

a- Production characteristics

As regards expenditures on inputs for production, the regression results show that expenditures on variable inputs has a negative effect on the farmer's markup. The opposite effect is observed with fixed inputs expenditures. The markup increases with fixed expenses. The importance of variable inputs in production (Table 12) reinforces these results. In fact, based on the expression of the markup (expression 3) derived by De Loecker and Warzynski (2012), farmers with low expenditures on fixed inputs would be constrained to increase their expenditures on variable inputs (expenditure on fixed inputs corresponding to an improvement in technology). And consequently, these farmers would have a low markup. However, an increase in spending on fixed inputs would improve the technology and therefore reduce spending on variable inputs, and thus increase the markup. It is in this sense that De Loecker and Eeckhout (2018) concluded that the markup helps to identify the role of technology in market power. So, increasing fixed inputs and thus improving technology would allow the producer to increase his market power.

b- Farmer's characteristics

It appears that being educated and having more experiences have a positive effect, but this effect is not statistically significant on the markup. We observe significant and positive effect for the sex of the farmer. Being a female helps to take advantage by increasing the markup. This would be explained by the fact that there are higher investments (fixed and variable costs) on average for women compared to men. Also unobserved characteristics (e.g. the ability to negotiate a better selling price) could drive this effect.

c- Finance and training

Having outstanding loans has a negative effect on the farmers' markup. According to Soglo and Assogba (2009), Tandjiekpon (2010) and Swinnen et al. (2013), farmers to meet production expenses and certain social problems receive credit from potential buyers (most of the time through purchasing contracts) or other sources. They are therefore obliged to sell off their production in order to meet their commitments to creditors. They would therefore tend to receive low prices and therefore a low markup.

Concerning the fact that the PO is financed by the PROFI project, the results show a positive effect on markup. Belonging to a PO financed by the project would therefore alleviate the financial constraint faced by the farmer as a result of the investments received. It will be interesting to better understand the effect of this variable through a before-after comparison of the project.

d- Selling characteristics

It appears that farmers in POs where marketing is organised individually perform better than those where sales are organised collectively. It could be assumed that farmers who sell individually would have better quality cashew nuts or a better structured sales network with well-defined contracts that force them to sell to specific buyers and get better prices. Also, the mode of internal governance of the PO to which the farmer is a member could matter for its ability to have a certain level of markup. Maybe there are some specific characteristics that driven the negative effect of negative sales. A specific characteristic could be who decides where and to whom PO members should sell. However, without data on the quality of the cashew nuts traded and any contracts established, we cannot make clear conclusions on these results.

Sell in the official marketing period helps farmers to increase theirs markup compared to those who sell before this period. We show in graphs 3, 4 and 5 that the regulatory price set by the government is not systematically applied during sales. However, it could have an effect on the prices applied during cashew nut sales operations. It could be interpreted as a signal from the government by the farmer and give them more bargaining power. This is what Russo et al. (2011) argue by showing that fix a minimum farm price prevents buyers from exercising their market power in an oligopsony situation. Even if we find a non-significant effect of the storage duration on the farmers' markup, it will be important to help farmers by improving their capacity and storage conditions. Soglo and Assogba (2009) identified the storage as a problem for the sector. And in this case, farmers cannot therefore store and wait for the marketing period to speculate on price.

e- Type of buyers

The regression shows that compare to local market, the union have negative effect on farmer’s markup. Farmers would therefore be disadvantaged in the sharing of rents vis-à-vis to their union compare to when they sell to local market. The negative effect observed here for the union explain the results find previously concerning the type of seller. Indeed, we found that individual sellers are doing better than collective sellers. And this is reinforced by the graph 10 where, we see that, the individual sellers sold mainly to local market compare to collective sellers who sold to the union. So, there is some heterogeneous result concerning the effects of intermediaries on the rents sharing or on the farmer’s markup. Consistent with the results of Huang and Sexton (1996), Alston et al. (1997) and Sexton (2012), we can argue that the presence of intermediaries in the agriculture sector disadvantage farmers (the case of union here). Contrary to these studies showing the negative effect of intermediaries, our results show a positive effect of the local market on the farmers' markup. There are therefore specific characteristics

of each buyer that influence the farmers' markup. A study on the definition of the markup at the level of the different actors in the sector (including intermediaries/buyers) would be necessary to isolate the specificities of each actor at each level of the marketing chain.

VI- Conclusion

The structuring of trade through globalization is subject to studies that try to highlight the consequences on the well-being and/or the rent of producers in developing countries. Some studies show benefits (Minten et al., 2007; Murthy, 2011) for farmers while others, on the contrary, have shown negative effects (Swinnen and Vandeplas, 2011; Richard 2012; Maertens and Swinnen, 2014; De Loecker and Eeckhout, 2018). Whether positive or negative, the effects of farmers' participation in international trade are a consequence of their ability to have some market power or a high markup. Richard (2012) and De Loecker and Eeckhout (2018) have shown that market power depends on the characteristics of each producer who benefits differently from globalization. However, these producers in developing countries are involved in international market trade through their dealings with buyers/exporters on the domestic market who act in an oligopsony situation. In this study, we focused on these interactions in the domestic cashew nuts market in Benin in order to highlight the characteristics of farmers that significantly affect their markup.

As a result, the study shows that farmers' markup is higher for women. This allows to assume a possible unobserved variable. In line with De Loecker and Eeckhout (2018) who argue that the markup identifies the role of technology in market power, the results of our study show that farmers' markup would increase with fixed input expenditure and a decrease in variable input expenditure (synonymous with better technology). Further than Richard (2012) and De Loecker and Eeckhout (2018), we find that in addition to the characteristics of the producer, the type of buyer also matters for the markup. Contrary to idea that the presence of intermediaries is harmful for farmers (Alston et al., 1997; Sexton, 2012), we find a positive effect for local market. But negative effect consistent with these studies is find when the intermediary is union. Another constraint on the markup is observed when farmers have outstanding loans. Farmers would be forced to sell their products even at low prices to meet their financial requirements. However, this financial constraint could be mitigated with the positive effect on markup when the PO is financed by the project PROFI. The negative effect observed when sales are made collectively in relation to farmers who sold individually allows us to assume that the internal governance of the POs of which the farmers are members also plays an important role on the profit margin. Figure 10 shows that farmers who sell collectively are those who sold mainly to the union, which has a negative effect on the markup. On

the other hand, those selling individually sold their product mainly on the local market which has a positive effect on the farmers' markup. Also, the marketing period have positive effect on farmer's markup. The marketing price define by the government would allow farmer to increase their bargaining power even if this minimum price is not enforced on the field.

In conclusion, the regression results show that the markup is influenced by the producer's characteristics, the production characteristics, the type of buyer, the selling period and to some extent by the internal governance of the PO to which he belongs. Any policy, reform or programme aimed at improving the cashew value chain for the benefit of farmers will need to take actions at three possible levels. Firstly, improving the institutional framework of the sector in order to make each actor comply with government decisions in the sector (respect of regulation price and purchasing standards, respect of collection and marketing periods and formal identification of collectors and buyers). Secondly, it is necessary to improve the individual capacities of producers to take advantage of the benefits of globalization through exported agricultural products. This means supporting them in the usefulness of increasing investments in the renewal and/or maintenance of plantations and in the improvement of their production and storage techniques. Thirdly, to carry out actions aimed at improving internal governance in POs in order to increase their market power vis-à-vis buyers and improve the well-being of farmers. These recommendations are in line with the four following specific results/objectives defined by Enabel-Benin in the PROFI project.

- ***Result 1:*** Professionalized family farms offer a competitive product in clearly identified growth markets.
- ***Result 2:*** Rural businesses provide quality services accessible to farms in the commodity chains.
- ***Result 3:*** Communal infrastructures are built and developed following a concerted process between the actors of the sectors.
- ***Result 4:*** The governance and performance of the priority sectors are improved thanks to a better articulation of the operators, with respect for the environment and gender equity.

But a before-after analysis is important to determine what worked well or poorly during implementation. This will help to improve future interventions by both development actors and government in the sector.

The work only focuses on the correlation between markup and the independent variables. However, it could be improved by doing a before and after the project analysis. This kind of analysis will help to also to quantify the level of the effects of the independent variables. Also, results could be improved by controlling for some variables

not existence in the data base. Such variables could be for instance the age of the cashew trees, the quality of the nuts (KOR), the indicators specific to the internal governance of the POs and the characteristics of each buyer. They could affect both the level of production and the level of the markup. Finally, to generalize the results, the sample size could be increased. In fact, our study is based on 261 cashew producers out of an estimated 200,000 producers by the Ministry of Agriculture in 2017.

VII- Bibliography

Adkins, L. C. & Hill, C. R. (2011). *Using Stata for Principles of Econometrics, Fourth Edition*. Wiley Global Education. ISBN-13 978-111-803208-4

Aïvodji, J., & Anasside, A. (2009). *"*Élaboration des Règles de Stabilisation et de Soutien des Prix pour la Filière Anacarde". *ONS, Projet d'Appui à la Sécurisation des Revenus des Exploitants Agricoles (PASREA), 73*.

Akomagni, A.L. (2017). *Etude Diagnostique du Fonctionnement du Marché de L'anacarde et Perspectives sur les Politiques Nationales de Développement de la Filière au Bénin*, Rapport final.

Allagbe, I. C., Adegbola, I. P., Adjovi, I. N. A., Komlan-Ahihou, I., Gfdjce Crinot, I. P., & Ir, A. J. P. (2014). "Rapport Technique d'exécution". *Article de revue*. 45p

Alston, J.M., Sexton, R.J., and Zhang, M. (1997). *"The Effects of Imperfect Competition on the Size and Distribution of Research Benefits"*; In: Sexton R.J. (2012). "Market Power, Misconceptions, and Modern Agricultural Markets", American *Journal of Agricultural Economics* 95 (2), 209-219.

Amemiya, T. (1981). *"Qualitative Response Models: A Survey"*; in: Dougherty, C. (2011). *Introduction to Econometrics*. Oxford University Press.

Calderone, M., Houssa, R., Reding, P., Olodo, M., & Zohoungbogbo, M. O. (2018). "Designing a Randomized Impact Evaluation on a Belgian development program: The Case of the PROFI Program in Benin" (No. 0125). *University of Namur, Department of Economics*.

Ceko, E. (2013). *Marketing Research and Strategy Towards Globalization and Challenges in Management.*

Christiaensen, L., Demery, L., & Kuhl, J. (2011). "The (evolving) Role of Agriculture in Poverty Reduction: An empirical perspective". *Journal of development economics*, 96(2), 239-254.

Collier, P. and Dollar, D. (2001). "Globalization, Growth and Poverty: Building an Inclusive World Economy." Retrieved from https://books.google.fr/books?hl=fr&lr=&id=p3D_BYtXXQcC&oi=fnd&pg=PR13&dq=Collier,+P.+and+D.+Dollar+(2001).+%E2%80%9CGlobalization,+Growth+and+Poverty:+Building+an+Inclusive+World+Economy.%E2%80%9D+Oxford:+Oxford+University+Press.&ots=GJ-uLY3i7o&sig=EeSDxwDb-Quf7Kzh1Sv2x-jH79s#v=onepage&q&f=false.

Dougherty, C. (2011). *Introduction to Econometrics*. Oxford University Press.

De Loecker, J. and Eeckhout, J. (2018). "*Some Thoughts on the Debate About (Aggregate) Markup Measurement".*

De Loecker, J. and Eeckhout, J. (2017). "The Rise of Market Power and the Macroeconomic Implications" *NBER Working Paper* No. 23687 August 2017 JEL No. D2, D4, E2, J3, K2, L1.

De Loecker, J. and Warzynski, f. m. p. (2012): "Markups and Firm-level Export Status," *American Economic Review*, 102(6), 2437–2471

EOS (2017). *Winners and Losers from Globalization and Market Integration: Insights from Micro-Data;* Call 2017 – Application form

Evin, J. (2000). *Filière Anacarde au Bénin, Note d'Information n°1,* Réf. : DPP/MDR/CSN/053/00/JE

Houssa, R., Calderone, M., Gbetondji, N. A. M., Amegnaglo, C. J., Achigan-Dako, G. E. (2018) "Improved Seed Adoption and Agricultre Performance in Benin". Draft of BeFind working paper, august 2018.

Houssa, R., & Verpoorten, M., (2015). "The Unintended Consequence of an Export Ban: Evidence From Benin's Shrimp Sector." *World Development* 67: 138-150.

Huang, S.-Y., and Sexton, R.J. (1996). *"Measuring Returns to an Innovation in an Imperfectly Competitive Market: Application to Mechanical Harvesting of Processing Tomatoes in Taiwan"*; In: Sexton, R.J. (2012). "Market Power, Misconceptions, and Modern Agricultural Markets", American *Journal of Agricultural Economics* 95 (2), 209-219.

IMF (2011). "Bénin : Document de Stratégie pour la Réduction de la Pauvreté (2011-2015)*". Rapport du FMI n° 11/307*

INSAE (2019), *Grands traits du commerce extérieur au Bénin.*

Kirsten, J., & Sartorius, K. (2002). "Linking Agribusiness and Small-scale Farmers in Developing Countries: is there a new role for Contract Farming?" *Development Southern Africa*, 19(4), 503-529.

MAEP Bénin (2017). *Plan Stratégique de Développement du Secteur Agricole (PSDSA) 2025 et Plan National d'Investissements Agricoles et de Sécurité Alimentaire et Nutritionnelle PNIASAN 2017 – 2021.*

Maertens, M., Swinnen, J. (2015). "Agricultural Trade and Development: A Value Chain Perspective", *WTO Staff Working Paper*, No. ERSD-2015-04, World Trade Organization (WTO), Geneva, http://dx.doi.org/10.30875/c23f13a6-en.

Martinez, S.W. (2002). "A Comparison of Vertical Coordination in the U.S. Poultry, Egg, and Pork Industries, Current Issues in Economics of Food Markets", *Agriculture Information Bulletin*, n° 747-05, 6p.

Minten, B., Randrianarison, L. & Swinnen, J. F. M. (2007). "Spillovers from High-Value Export Agriculture on Land Use in Developing Countries: Evidence from Madagascar", *Agricultural Economics, 37(2-3), 265-275.*

Murthy, R. R. (2011). "Does Vertical Integration Benefit Cotton Farmers? Encouraging Evidence from an Experiment in Andhra Pradesh". *IUP Journal of Agricultural Economics*, 8(4), 41.

Ricau, P. (2013). "Connaître et Comprendre le Marché International de l'anacarde". *Lyon: Rongead*.

Russo, C., Goodhue, R.E., and Sexton, R.J. (2011). *"Agricultural Support Policies in Imperfectly Competitive Markets: Why Market Power Matters in Policy Design."* American Journal of Agricultural Economics 93:1328 1340; In: Sexton, R.J. (2012). "Market Power, Misconceptions, and Modern Agricultural Markets", American *Journal of Agricultural Economics* 95 (2), 209-219.

Sexton, R.J. (2012). "Market Power, Misconceptions, and Modern Agricultural Markets", American *Journal of Agricultural Economics* 95 (2), 209-219.

Soglo, A., & Assogba, E. (2009). "Etude sur la Compétitivité de la Filière Anacarde du Bénin". *Rapport final, Ministère du Commerce, CCI (PADEX), April.*

Swinnen, J., Colen, L., and Maertens, M. (2013). "*Constraints to Smallholder Participation in High-Value Agriculture in West Africa";* In: Rebuilding West Africa's Food Potential, A. Elbehri (ed.), FAO/IFAD.

Swinnen, J. F., & Vandeplas, A. (2010). "Market Power and Rents in Global Supply Chains", Agricultural *Economics*, 41, 109-120.

Tandjiékpon, A. M. (2010). *Analyse de la Chaine de Valeur du Secteur Anacarde du Bénin*. Rapport d'étude, Initiative du Cajou Africain (ICA/GIZ), Bénin, 62.

White, L.J. (2012). "Market Power: How does it Arise? How is it Measured?" *NYU Working Paper* No. 2451/31547.

VIII- Annex

Annex 1: Results of the estimation of Cobb-Douglas production function

Robust OLS results for Cobb-Douglas production function: regress logarithm of the value of production on the value of inputs (variables and fixed) and farmer's, seed, worker's and land characteristics

Dependent variable: Logarithm of the value production per ha	**(1)**	**(2)**
Robust standard errors in parentheses	coef./robust	coef./robust
****** p<0.01; **p<0.05; *p<0.10***	se	se
Production characteristics		
Logarithm of value of variable inputs per ha	**0.686****	**0.685****
	(0.291)	(0.285)
Logarithm of value of fixed inputs per ha	0.027	0.024
	(0.044)	(0.048)
Farmer's characteristics		
Logarithm of years of experience in cashew	-1.168	-1.193
	(0.724)	(0.742)
Educated (1 if yes; 0 if not)	-0.312	-0.306
	(0.350)	(0.356)
Received training about production (1 if yes; 0 if not)	-0.058	-0.040
	(0.161)	(0.164)
The PO of belonging was financed by the project (1 if yes; 0 if not)	0.661	0.686
	(0.614)	(0.621)
Worker's characteristics		
Sex of dominant worker (1 if woman; 0 if man)	-0.000	0.001
	(0.202)	(0.203)
Logarithm of family labour force	0.921	0.920
	(0.593)	(0.608)
Logarithm of non-family labour force	-0.221	-0.226
	(0.207)	(0.215)
Seed and plot characteristics		
Seed quality (1 if improved seed, 0 if not)	**1.481****	**1.475****
	(0.627)	(0.663)
Logarithm of the number of years the plot has been in use	0.901	0.938
	(0.595)	(0.622)
Having a right of use the plot (1 if yes; 0 if not)	**-0.714***	**-0.694***
	(0.399)	(0.401)
Constant	3.877	3.818
	(3.545)	(3.584)
Plot effect	No	Yes
Nbr of Obs.	119	119
R-squared	0.410	0.411
F-stat	2.921	2.502

Annex 2: Correlation between markup and farmer's observed characteristics

Robust OLS results for markup's determinants: regress logarithm of the markup on the production, farmers, finance and training, selling and buyer's characteristics

Dependent variable: Logarithm of markup	**(1)**	**(2)**
Robust standard errors in parentheses	coef./	coef./
****** p<0.01; **p<0.05; *p<0.10***	robust se	robust se
Production characteristics		
Logarithm of value of variable inputs per ha	**-0.917*****	**-0.918*****
	(0.034)	(0.034)
Logarithm of value of fixed inputs per ha	**0.039****	**0.043****
	(0.019)	(0.021)
Farmer's characteristics		
Farmer's sex (1 if woman; 0 if man)	**0.300***	**0.305***
	(0.158)	(0.160)
Educated (1 if yes; 0 if not)	0.032	0.029
	(0.090)	(0.093)
Logarithm of years of experience in cashew	0.064	0.062
	(0.111)	(0.112)
Finance and training		
Outstanding loan (1 if yes; 0 if not)	**-0.766****	**-0.764****
	(0.389)	(0.387)
Received training about commercialization (1 if yes; 0 if not)	-0.202	-0.205
	(0.127)	(0.131)
The PO of belonging was financed by the project (1 if yes; 0 if not)	**0.406***	**0.406****
	(0.208)	(0.206)
Selling characteristics		
Type of seller (1 if collectively; 0 if individual)	**-0.178***	**-0.176***
	(0.096)	(0.101)
Sale ratio relative to production	0.226	0.241
	(0.164)	(0.178)
Number of month the product is stored before sold	0.064	0.067
	(0.055)	(0.056)
Month of sale (1 if sold in the marketing period; 0 if not)	**0.399****	**0.392****
	(0.158)	(0.154)
Type of buyer		
Union (1 if sell to this buyer; 0 if not)	**-0.204***	**-0.202***
	(0.114)	(0.113)
National private (1 if sell to this buyer; 0 if not)	0.191	0.184
	(0.140)	(0.139)
Foreign private (1 if sell to this buyer; 0 if not)	0.066	0.065
	(0.174)	(0.175)
Constant	8.971***	8.941***
	0.511	0.523
Plot effect	No	Yes
Nbr of Obs.	280	280
R-squared	0.740	0.740
F-stat	60.166	53.050