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Transactions Costs Approach and Application to Vertical Coordination Arrangements in Moroccan Apple Marketing

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Abstract

In Morocco, agricultural aggregation projects (AAP) have been launched since a decade as being a form of vertical coordination aimed at correcting the marketing failure associated with spot markets arising due to information asymmetry as being behind the risks in marketing decision-making. AAP is considered to be the keystone of national agriculture, making it possible to overcome the difficulties linked to the size of farms. However, the scale of the transaction costs in agricultural aggregation projects (AAP) of the local apple producers remains so far less understood. The objective of this study is to investigate whether ex-ante costs of negotiating an AAP and the ex-post costs influence the adoption of relational transactions in Moroccan agricultural marketing and measure the social costs that are not common in previous studies, thus contributing to the development of literature. The study revealed that the transaction costs of this project total approximately 1207600 MAD. In this study, the abovementioned issues were investigated using a propensity score matching technique through a binary probit model to examine the transaction costs faced by apple producers members in agricultural aggregation projects and non-aggregated members, and therefore investigate the role of contract arrangements in reducing the aforementioned costs using a questionnaire-based survey in Atlas Mountains of Morocco. Results showed that the cost of negotiation and enforcement costs were revealed as the main variables which impede apple producers' participation in aggregation marketing, while the costs related to information search, harvesting, and transportation were the main obstacles to the participation of the non-aggregated members in the traditional spot market. Results also highlighted that the large-scale producers would be highly advantageous in aggregation projects compared to smallholder farmers.

Keywords

Agricultural aggregation projects, apple market, probit analysis, transaction costs, vertical coordination

1. Introduction

In Morocco, as in other African countries such as Nigeria and South Africa, vertical coordination arrangements plays a key role in crop production and marketing in rural regions, where this process is being promoted by AAP. This study focuses on the fruit tree sector and particularly apple, which is our main target commodity because of its popularity and

the significance in aggregation project. Apple is one of the most important cash crops in Draa-Tafilalet region located in Atlas Mountains of Morocco. In this study, we suggest that a farm is involved in aggregation project when the operators use aggregation contracts to sell their product. AAP are written agreements between a cold storage warehouse, processing units or packing stations and a grower.

Moroccan contract farming has evolved over time, especially as it has become focused on dairy industrial crops, and dairy production post-1985. However, the protectionist and interventionist policies of the first phase started to phase out in 1985, giving way to a system of a regulated economy. This second phase, corresponding to the period of 1985 to 2008, coincided with the implementation of important economic reforms through the programs known as stabilization and structural adjustment which were extended to the agricultural sector in 1985. These reforms were articulated around two major themes which were the disengagement of the State, on the one hand, and the liberalization of international trade, on the other hand [1]. Current contract farming in rural areas has changed and evolved considerably over time [2]. However, the mixed results posted by a number of AAP still has a huge effort to make for CF development [3]. Contracts specify commitment and terms, while the agreement outlines the details of exclusivity of sales. Contracts specify commitment and terms for implementation a trade agreement, under a contractual arrangement in Moroccan apple marketing. The fundamental difference between apple producer members in AAP and non-aggregated members is that agricultural aggregation involves the contract between the two parties, aggregated (apple producer) and aggregator (cold storage warehouses, processing units or packing stations). A valid contract is an agreement, which is binding and enforceable. In a valid contract, all the parties are legally bound to perform the contract. The aggregation contract Act, 04/12 defines and lists the essentials of a valid contract through the departments of provincial direction of agriculture in Midelt relevant to Tafilalt agricultural development regional office (TADRO). AAP is a form of vertical coordination largely aimed at correcting the marketing risk associated with free markets arising due to information asymmetry. It is considered to be the keystone of the national agriculture, making it possible to overcome the difficulties linked to the size of farms. However, the transaction costs scale in AAP of Moroccan farmers is yet not well understood. However, the impact of agricultural aggregation projects (AAP) on the welfare of Moroccan farmers' remains, so far, less understood. While some authors have considered that agricultural aggregation improves the smallholder farmers' access to ready markets, other studies have suggested that AAG lowers their incomes because the cold storage wield greater market power over the apple producers [4, 5].

Therefore, the main objective of this study is to provide a rigorous assessment of the different subfields of transaction cost faced by apple farmers in Morocco. More precisely, we would like to examine whether the participation of apple producers in aggregation projects has any impact on the transaction costs for those farmers aggregated, and non-aggregated. In achieving this goal, the paper provides a rigorous diagnosis and a clear picture of the AAP status in Morocco, which may be of a great help for polices and decisions makers. Thus, first, the study makes a novel contribution by applying propensity score matching method [6]. Second, the paper provides a detailed analysis of the role of transaction costs in determining market participation of apple farmers in Morocco, and discusses in light of the commercialization challenges in this sector. As well, we take the perspective of transaction cost economy, attempt to directly measure the transaction costs faced by apple producers, and seek to explain the determinants and consequences of producers' vertical coordination mode choice by means of a questionnaire-based survey. Apple is today an important component in Moroccan fruit trees sector with more than 778.800 tons per year .Its value chain development is expected to be boosted by agricultural policies, able to correct market failure, to assure access to agricultural inputs supplies and markets for smallholder farmers, and to endow farmers with the benefits of operational economy of scale and thus, to enhance the negotiation capabilities of apple producers along with proposing efficient solutions to marketing problems.

This article has four specific objectives: (1) assessing the magnitude of different types of transaction costs for apple farmers, (2) examining the role of aggregation contract on the likelihood of a farmer experiencing particular transaction costs, and then (3) analyzing the impact of agricultural aggregation projects on the reduction of transaction costs and enhancing market participation. The rest of this paper is organized as follows: The next section describes the apple sector in Morocco, and the role that AAP play and also the data used in this study. Then, a presentation of the analytical framework in Section 3. Subsequently, the empirical techniques used in the study are presented in section 4, whereas the section 5 comprises the empirical results and discussion, and finally, the conclusion and policy implications are drawn in the last section.

2. Literature Review

Transaction costs were conceptually introduced by Nobel laureate in Economic Sciences Ronald Coase, has explained that organizations and institutions are a means for reducing transaction costs, increasing profitability and improving the economic performance [7]. Furthermore, some New Institutional Economics (NIE) approaches have been used in an attempt to serve as a guidance in decision-making and enable a higher organizational efficiency (Ronald

Coase, Douglass North, Oliver Williamson and Elinor Ostrom). With regard to the transaction cost theory (TCT), it is notable that outside resources are available to the organization by means of various forms of relational contract, which may be used by the firm if the costs of internal resources are not preferential over external ones [7]. In the Neoclassical economic theory, markets are the coordination mechanism that maximizes resources allocation. This leads to a question raised by [7] why do firms exist? In the article ‘‘the nature of the firm’’ by [7], who answered this question with the fact that there is a cost to use the price mechanism, called transaction costs. Firms can reduce those costs and, consequently, market and non-market organizations can be compared in terms of importance of transaction costs.

The author states that the transaction costs incurred by activities such as drawing up a contract, preparing a bid document, dealing with any deviations from contract conditions, and administering the contract would have needed further consideration. [8] submits that accounting issues are essential in clarifying why the total organizational costs of the activities different among firms. However, for cases in which the accounting measures are difficult to precisely specify, they may place an undue burden on costs of organizing. Therefore, the effectiveness of any action undertaken is, influenced by their effect on the efficiency with which the accounting system operates. In fact, the uncertainty issue is particularly significant for measurements which are influenced by deficiency in the accounting systems. In this regard, transaction cost theory factors are clearly relevant to a range of issues with which accounting scholars are concerned.

[9] emphasizes this point when he defines the concept of transaction costs associated with information, contracting as arising before the transaction, negotiation, monitoring as costs of ensuring that the terms of the transaction are adhered, coordination, and enforcement of contracts. He theorizes the emergence of novel intermediary firms or incentive structures that significantly reduce these costs, and access to this new form of vertical coordination. Overall, the TCT originates from the “New Institutional Economics” approach and focuses on institutions of governance. It assumes that the firms are transaction cost-minimizing arrangements, which could change and need to evolve as nature of the governance change and sources of transaction cost [7, 10]. Thus, unlike in the past, transaction cost economics (TCE) says that organizational structures of firms are created to reinforce and consolidate business transactions in particular as regards the minimization of transaction costs [11] and highlights the importance of various administered vertical exchange arrangements, stating that “if transaction costs are negligible, the organization of economic activity is irrelevant”. Part of the aim of the theory of TCE is to develop a contractual approach to the study of organization [12].

Recent trends in economic relationships tend to turn increasingly towards TCE, ranging from lateral and vertical integration to market channel selection, make-or-buy decision, as well as contract arrangement [13-15]. However, a number of empirical studies are based on a cost-benefit analysis showed that the transaction costs were zero through time, whereas TCE assumes that exchanges are not costless [16-19]. Regarding the contract arrangement, [20] identifies three types of major contractual relationships depending on the type of vertical coordination process: relational (which, based upon a relationship of trust between the parties to which it pertains), classical, and neoclassical (which, based on the third party assistance is used for resolving disputes or evaluating performance). [20, 21] found that three major factors contribute to determine the levels of transaction costs are determined by: (1) the frequency at which transactions between the parties take place (2) the uncertainty involved in the transaction, (3) and the asset specificity in relation to the transaction, like site specificity, physical asset specificity, dedicated assets, and human asset specificity. The specific investments are mainly characterized by the complexity of the transaction, uncertainty, and frequency, result in a change in the forms of coordination from classical to neoclassical to bilateral and finally to unilateral relational contracts [20]. The main underlying assumptions of the TCE are the opportunistic decision behavior in contractual relations and bounded rationality [22]. The same author defines opportunism as ‘self-interest seeking with guile’, which includes behaviors such as cheating, lying, stealing, and considered efforts to distort, mislead, disguise, obfuscate or otherwise confuse [20].

The reason for its popularity is that it provides operators with the most efficient trading tools on the market, yet also determined other factors institutions which can influence the market mechanism above the outstanding role of the price. Information, negotiation, and monitoring costs arise in any transaction and can influence the vertical coordination outcome [23].

3. Methods

3.1 Description of the study area

This study was undertaken in the Midelt province that was established under Decree No 2.15.10 of 20 February 2015. It was established as part of implementing the advanced regionalization adapted by the Moroccan Constitution of 2011 [24]. The study area extends over an area of 13 626 Km² and is located in the Middle Atlas of Morocco, corresponding to 1521 m altitude, representing 15,3% of the area of the Drâa-Tafilalet region (Fig. 1). All types of agricultural production are found in the area ranging from fruit crops and field crops, rearing livestock to part-time agriculture.

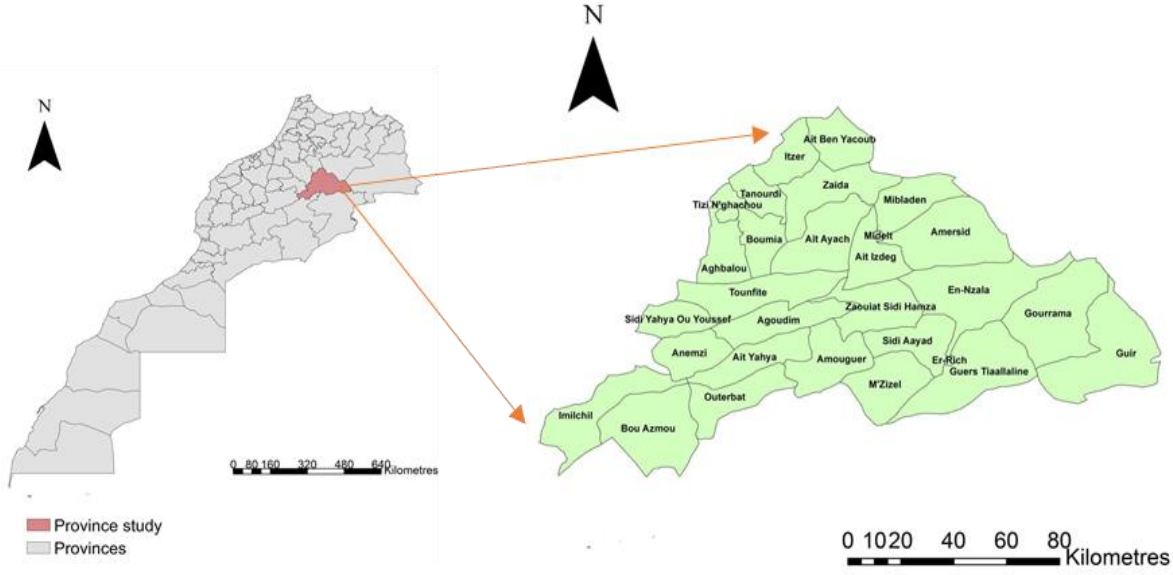


Figure 1. Map of the Study Area - Midelt province.

3.2 Data collection instrument

This study focuses on the apple tree sector in Morocco, because of their importance and the significance in aggregation project, and Apple is one of the most important cash crops in Draa-Tafilalet region. In this work, we define that a farm is participated in aggregation project if the apple producer use aggregation contracts to sell their product. Aggregation contracts are written agreements between a cold storage warehouses, processing units or packing stations and a grower apple to transfer the ownership of the commodity in question at some time in the future. Contracts specify commitment and terms of the contract, and agreement outlines the details of exclusivity of sales. The fundamental difference between apple producers members in AAP and non-aggregated members is that agricultural aggregation involves the contract between the two parties, aggregated (apple producer) and aggregator (cold storage warehouses, processing units or packing stations). A valid contract is an agreement, which is binding and enforceable. In a valid contract, all the parties are legally bound to perform the contract. The aggregation Contract Act, 04/12 defines and lists the essentials of a valid contract through Departments of Provincial Direction of Agriculture Midelt of the Tafilalt Agricultural Development Regional Office (TADRO). Law 04-12 of the aggregation act enumerates the points of essentials for valid contracts.

The research was conducted in three stages: desk research, structured interviews, and a questionnaire survey. A similar approach has been already used by [25]. Firstly, the desk research allowed the study of the primary documents of the AAP, such as the project documents, that contain information on the administrative and technical management rules and processes related to AAP, and law 04-12 on agricultural aggregation and therefore provide a solid initial approach of the functioning of the project and the main steps in the whole administration and regulations process. Secondly, in-depth interviews with various stakeholders involved were carried out. In total, one hundred and twenty project recipients were interviewed (53% of the total producer's members in the agricultural aggregation project), five representatives of the administrative bodies, and aggregator (cold storage warehouses). All the interviews were carried out from May – December 2021.

After identifying the transaction costs of the project process and defining cost levels for each actor, an allocation is made of costs related to the area covered by the project; which holds approximately 14,000 hectares in total. The second level of allocation is a series of reference tables that provide a summary of transaction costs by apple producer's members in the agricultural aggregation projects. Moreover, in order to ensure a maximum of representatively, it was decided that the transaction costs of participation so calculated for each sampled producer should be weighted by the quantity of sold products under the aggregation contract. As shown in Table 1, the approach consists of the identification of the actors involved in each stage of the project cycle: Regional Direction of Agriculture Midelt (DRA-MT); Agency for Agricultural Development (ADA); Regional Offices for Agricultural Reclamation and Development Tafilalt (ORMVAT); Coordination Service (DRA) with ADA (SCADA); Aggregator (AG); Aggregated (Ag).

This process should already have begun during the project preparation phase (step I), various meetings with the administration and establishment of contacts with the apple producers (step II), and meetings to examine the application,

processing, negotiation, and final decision on selection by the by a technical committee (step III), negotiating the final agreement (step IV). The latest step is effective project approval and provides certificates of aggregated (apple producers) and aggregator (cold storage warehouses) step V.

Two types of transaction costs incurred by an AAP were identified for analysis in this study. The first category was transaction cost incurred by actors involved in each stage of the project cycle in monetary terms during the implementation of an AAP. They include search costs (X1), negotiation costs (X2), approval costs (X4), validation costs (X4), and registration costs (X5) which were obtained as pre-implementation data. The second category was transaction cost incurred by actors involved in terms of time and resources spent during implementing AAP activities. Payments include transaction costs of monitoring (X6), verification (X7), and cost of enforcement (X8). Includes costs of administrative and legal measures incurred in the event of departure from the agreed transaction which was obtained as implementation data (Table 1).

Table 1. Definition of transaction costs components in the AAP cycle, their descriptions and measurements.

Transaction Cost Components	Description	Actors involved in each stage of the project cycle.	Measurements
	Pre-implementation		
Search costs	Costs incurred by investor and administrations as they seek out apple producers for aggregation projects	DRA-MT ADA ORMVAT SCADA AG	Commitment of resources to the project MAD/ project cycle (X1)*
Negotiation costs	Includes public administration meetings with key stakeholders.	ADA ORMVAT SCADA AG Ag	Staff cost MAD/ project cycle (X2)*
Approval costs	Costs of authorization from administration	ADA SCADA ORMVAT	Cost of authorization from administration during the approval process MAD/ project cycle (X3)*
Validation costs	Review and revision of project design document by public administration	ADA	Cost of review and revision of project design document MAD/ project cycle (X4)*
Registration costs	Registration by law courts , and banking administration Issuance of certified AAP of aggregated (apple producers) and aggregator by AAP executive board /supervisory committee.	AG Ag ADA ORMVAT SCADA	Cost for registration by law courts , and banking administration MAD/ project cycle (X5)*
	Implementation		
Monitoring costs	Costs for project monitoring	AG Ag ADA	Time spent for project monitoring MAD/ project cycle (X6)*
Verification costs	Evaluation committee and to report to the public administration	AG ADA ORMVAT SCADA	Time spent by evaluation committee MAD/ project cycle (X7)*
Enforcement costs	Includes costs of management and breach of contract	AG ADA Ag	Enforcement costs MAD/ project cycle (X8)*

Sources: own additions *Converting Data to Monetary Value

In the current study, we used propensity scores and careful sampling to closely match a sample of aggregated members (N = 120) with a group of non-aggregated (N = 70) who had not participated in the project. A well-fitting structural equation model (SEM) indicated that compared to farmers who have never been in agricultural aggregation project,

farmers aggregated less affected by transaction costs. The current study adds to the literature by using propensity scores to closely match foster apple producers members in agricultural aggregation project, and non-aggregated members on factors that may be associated with information costs, negotiation costs, enforcement cost, transportation costs, producer demographics, and farm characteristics. We, therefore, used structural equation modeling (SEM) to examine differences in the transaction cots factors affecting apple producers with respect to participate in AAP in the apple sector in Morocco. Data collection was undertaken in 2021. Separate lists were compiled of apple producer's members in agricultural aggregation project selected for this study and those for the non-aggregated members were prepared with the help of community service officers, concerned Departments of Provincial Directions of Agriculture, Agency for the Agricultural Development, and Tafilalt Agricultural Development Regional Office. A sample of 190 apple producers who were members and non-aggregated members covers the apple growing areas (Boumia, Zaida, Midelt, Rich, Imilchil).

In terms of the research questions, the study uses the primary data which had been collected by means of semi-structured questionnaire. The data that was collected through questionnaires is made up of farm characteristics and socioeconomic variables, and transaction cost variables (Table 2). Once prepared, the questionnaires were discussed with extension officers and stakeholders; it was then be pre-tested to ensure validity and reliability of the data that is to be collected. After the approval of questionnaires, face to face interviews were conducted by the investigators with apple producer's members in agricultural aggregation project and non-aggregated members.

Table 2. Farm Characteristic and Socioeconomic Variable, and Transaction Cost Variables

Variable Description	Variable code	Unit	Measurement	Expected Sign
Farm characteristics				
Farm size	FS	Ha	Number of hectares	+
Number of apple trees	NAT	Number	Number of trees	+/−
Legal status of the land	LSL	Owner of a farm	1 = Yes 0 = NO	+
Yield	YD	T	T/ha	+
Farm gate price	FGP	MAD	MAD /Kg	+
Transaction costs	Variable code			
Socioeconomic Variable				
Age	AE	Years	Number of years	
Experience	EE	Years	Number of years spent in apple marketing	
Education	EN	Years	Years spent in formal education	
Membership to an association of producers	MAP	Membership	1 = Yes 0 = NO	
Information costs				
Market price information	MPI	days	Time committed to the market price information	+
Potential buyers research	PBR	days	Time spend looking for potential buyers	+
Organization of agricultural events	OAE	MAD	Money spend on organization of agricultural events intended in particular to promote agricultural marketing	+/−
Negotiation costs				
Trading price negotiation	TPN	days	Time committed to the negociation prior to sell products	+
Time to sorting fruit	TSF	days	Time spend sorting fruit before trading with buyers	-
Enforcement costs				
Payment deadlines	TFP	days	Number of days to receive the full payment	+
Expenditure on apple harvest	EAH	MAD	Cost of receiving apple buyers during the harvest process	+
Loss of buyers' breaking the transaction	LBT	MAD	Cost caused by buyer's breaking the contract: verbal or written agreement	+
Transportation costs				
Damage caused by transportation	DCT	%	Loss rates when transporting to the market.	+
Transporting apples to sales	TAS	MAD	Cost of transportation of product to sales sites b	+/−
Implementation of the AAP				
Social cost of AAP	SCA			

a Damage caused by transportation DCT = Price ×Production ×Percentage damaged and rotten apples during transporting process.
b Cost of transportation of product to sales sites = Total transport ting times per year × transportation cost per time

3.3 Propensity score matching and Econometric model

Propensity score methods have been extensively used in the recent years, notably in the areas of agricultural policy and contract farming [26-29]. The objective of this study is to examine the effect of AAP on the transaction costs. More precisely, we would like to examine whether the participation of apple producers in aggregation projects has any impact on the transaction costs for those farmers aggregated, and non-aggregated. We do observe the transaction costs of those farmers, through the comparison the data between apple producer's members in agricultural aggregation project, and non-aggregated members with similar observed characteristics [6-30]. We first assume that there are two potential outcomes, Z0 and Z1. Z1 is the outcome of the apple producer participating the aggregation project and Y0 is the outcome of the apple producer not participating the project. PSM is a two-step procedure. In the first place, the probabilistic model has been calculated for the participants in AAP via probability estimation. Consequently, this provides a participation propensity score for each observation. In the second step, each observation in the participated group (aggregated) is matched to one in the unparticipating group (non-aggregated) with a similar propensity score value in order to estimate the average aggregation effect for the aggregated (AAA), denoted as:

$$AAA = \frac{E(Z1 - YO)}{x}, D = 1) = E\left(\frac{Z1}{x}, D + 1\right) - E\left(\frac{Z0}{x}, C = 1\right) \quad (1)$$

Where, C is an indicator variable equal to one if the apple producer's members in agricultural aggregation project and zero otherwise. Z1 is the outcome for the aggregated observation, Z0 is that for the non-aggregated observation, and x is a vector of control variables. When project of agricultural aggregation is randomly adopted, we can replace E (Y0|x, D = 1) with E (Y0|x, D= 0). However, as mentioned above, the groups are not randomly distributed, and E (Y0|x, D = 1) is unobservable [6].

In order to investigate the determinants driven the AAP participatory behavior, a probit model was employed as the dependent variable (participating in AAP or not), which is a binary variable taking two values: 1, if the apple producer participates in AAP. Or 0, if the apple producer does not participate in AAP.

A Probit model was built:

$$\Pr\left(\mathrm{Y} = \frac{1}{\mathrm{X}}\right) = \Phi(\mathrm{X}'\alpha) \qquad (2)$$

Where:

Φ: Cumulative Distribution Function (CDF) of the standard normal distribution

P_r: represents probability,

X: vector of independent variables which are assumed to affect the outcome Y

Y: dependent variable which has only two possible outcomes denoting as 1 and 0,

X is the vector of independent variables which are assumed to affect the outcome Y, and α is the parameters which are typically estimated by maximum likelihood.

and α is the parameters which are typically estimated by maximum likelihood.

Moreover, if we suppose that an auxiliary random variable exists, the equation becomes:

$$\mathrm{Y}^* = \mathrm{X}^*\alpha + £ \qquad (3)$$

where, £~ (0, 1), Y* is a latent variable, Y is an indicator for whether the latent variable is positive:

$$\mathrm{Y} = \begin{cases} 1 \text{ if } \mathrm{Y}^* > 0 \; i.e. -£ < \mathrm{X}^* \\ 0 \text{ otherwise} \end{cases} \qquad (4)$$

$$\Pr\left(\mathrm{Y} = \frac{1}{\mathrm{X}}\right) = \Pr(\mathrm{Y}' > 0) = \Pr(\mathrm{X}^*\alpha + £ > 0 = \Pr(£ > -\mathrm{X}^*\alpha)$$

$$= \Pr(£ < \mathrm{X}^*\alpha)(\text{ by symmetric of the normal distribution}) = \Phi(\mathrm{X}'\alpha) \quad (5)$$

4. Results, and Discussion

4.1 Transaction costs for implementing an agricultural aggregation projects (AAP)

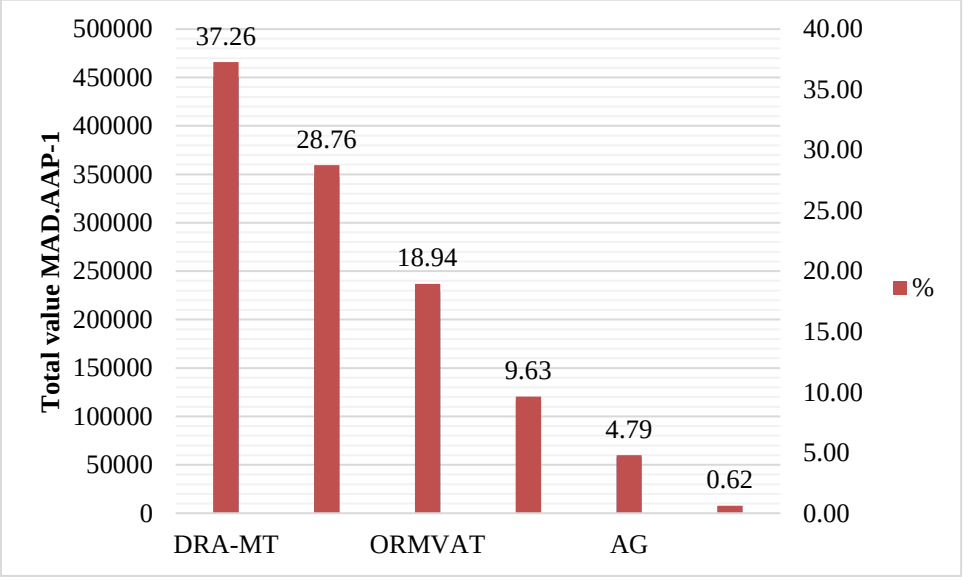
The AAP, operated by the Coordination Service (DRA) with Agency for Agricultural Development (SCADA), provides administrative support to investors who wish to develop projects consistent with the agricultural aggregation mechanisms under the law 04-12. The estimates of the transaction costs of this project have been made and these are presented in table3. Data has been supplied by staff at the actors involved in each stage of the project cycle. Moreover, the data in table 3 is based on region and project-specific data. We have tried to make this data more measurable and so have specified the transaction cost components, but also instead specified the actors involved in the project.

Table 3. Total transaction costs for implementing an AAP

Main category	Total value MAD.AAP^{-1}	Total MAD.yr^{-1}	Total transaction cost (MAD·ha −1 ·yr $^{-1}$ [%])
X1	785000	157000	80.51 (65)
X2	396500	79300	40.66 (32.84)
X3	2950	590	0.30 (0.25)
X4	1500	300	0.15 (0.12)
X5	8000	1600	0,82 (0,66)
Sub-total Pre-implementation	1193950	238790	122.44 (98.87)
X6	4900	980	0.50 (0.41)
X7	4500	900	0.46 (0.37)
X8	4250	850	0.43 (0.35)
Sub-total implementation	13650	2730	1.39 (1.13)
Grand total	1207600	241520	123.83 (100)

Source: Field surveys 2021, 1 USD = 9.43 MAD

The study revealed that transaction costs of pre-implementation for AAP are much too high (1193950 MAD) compared to implementation (13650 MAD) as transaction costs of monitoring, verification, and enforcement costs (Table 5). While this study's finding is based on the operational level transaction costs, the results indicated that the costs incurred by investors and administrations as they seek out apple producers for aggregation projects (X1) are the largest single component of transaction costs, accounting for an estimated 65% followed by negotiation costs (X2), accounting for 32.84%. These two categories account alone for almost 97% of the total transaction costs for implementing an AAP. For X1 and X2, the high proportion can be explained by the relatively large transaction costs of time and effort to public administration meetings with key stakeholders, and costs incurred by investors and administrations as they seek out apple producers for aggregation projects.



Source: Field surveys 2021, 1 USD = 9.43 MAD

Figure 2. Transaction cost incurred by actors involved in AAP.

Figure 2 shows the transaction cost incurred by actors involved in AAP. Based on the findings, if we consider all the actors in the AAP, the Regional Direction of Agriculture Midelt (DRA-MT) is the one accounting for the highest percentage of transaction costs 37.26% (450 000 MAD). For the Agency for Agricultural Development (ADA), Regional Office for Agricultural Reclamation and Development Tafilalt (ORMVAT) and Coordination Service with Agency for Agricultural Development (SCADA) account for a 28.76% (347 250 MAD), 18.94% (228 700 MAD) and 9.63% (116 250 MAD), respectively, of the total amount of transaction costs. The AG and the Ag account for the lowest percentage of transaction costs incurred for implementing an AAP. As shown in Figure 2, the percentage of transaction costs incurred by the Aggregator (AG), and Aggregated (Ag) account for a 4.79% (57 900 MAD), and 0.62% (7 500 MAD), respectively, of the total amount of transaction cost incurred by actors involved in AAP. Based on the outcomes, the

public administrations (DRA-MT; ADA; ORMVAT; SCADA) are the ones accounting for the highest percentage of transaction costs 94.59% (1 142 200 MAD if we consider all the administrations involved in AAP). it was revealed for the aggregator to be certified for the project Implementation certain transaction costs must be incurred including developing a project idea note, a feasibility report which is estimated to take one a month, a project negotiation process, various meetings with the administration and establishment of contacts with the apple producers that ends with the issuance of certified AAP of aggregated (apple producers) and aggregator by AAP executive board which takes an estimate of eight months. Economically, the implementation cycle of AAP can be understood as a problem of social cost, where the actions of actors impart a negative externality on aggregated. Problems in social cost can be understood by measuring the transaction costs assigned to various actors within the project cycle and can be modeled by reallocating total transaction cost (MAD·ha −1 ·yr -1) to different apple producers' members in the agricultural aggregation project to achieve economic equilibrium. This social cost of AAP has been allocated among apple producer members in the agricultural aggregation project, depending on the hectare of apple production, and is also added as an explanatory variable in the regression model (Table 5).

4.2 Descriptive statistics on farm characteristic and socioeconomic variable

Sixty three per cent of the surveyed farmers sold either all or at least one part of their production through an agricultural aggregation project. Descriptive results showed that selling apple production via a cold storage warehouses was still the main selection by farmers. Thirty-seven per cent of the surveyed farmers sold apple solely through the spot market, sold via a dealer or sell directly to processors. Detailed descriptive statistics are presented in Table 4. The descriptive statistics showed that the values of some variables did not vary much across the farmers nor relative to the dependent variable. These could be dropped from the regression analysis even though they seemed to be important in theoretical expectations. These variables were: age, gender, and legal status of the land. The experience variable did not show a strong relationship to the dependent variable in the correlation matrix. It was kept in the model estimation, as experience is generally believed to have an important impact on farmers channel selection. The transaction cost variables included in the analysis were: market price information, potential buyers research, organization of agricultural events, trading price negotiation, time to sorting fruit, time to wait for the full payment, expenditure on apple harvest, loss of buyers' breaking the transaction, damage caused by transportation, and transporting apples to sales.

There are a number of farm characteristic variables, which were expected to influence the dependent variable. They were the farm size, number of apple trees, yield, and price of apple per kilogram. This adds the socio-economic variables, which were expected to influence the dependent variable. They were the level of education, experience, and membership to an association of producers.

The farm characteristic and socioeconomic variable of apple producer members in agricultural aggregation project and non-aggregated members were analyzed and results are given in Table 4. These results were significant, indicating that farm participants had large farm sizes than those who trade in the free market. The average number of trees owned by apple producer's members in agricultural aggregation project was found to be 4884 trees, compared with 2442 trees for non-aggregated members.

Mean apple yield for aggregated members was found to be higher (36.96 t ha-1) than in the non-aggregated members (24.8 t ha-1). This is because the aggregator deals extension services to stabilize farmers' income. The results of this study also showed that the mean farm gate price in the aggregation project was significantly higher (3.74 MAD/kg) than in the free market (3.02 MAD/kg). This is because the aggregator offers a competitive price that leads to increased income per hectare, and reached 138230.4 MAD ha-1 in the farm contracted versus 74896 MADha-1 in the farm non-aggregated.

The average age for apple producer's members in agricultural aggregation project was relatively higher (53.41 years) than non-aggregated members (52.86 years). The findings revealed that more elderly farmers are likely to participate in the agricultural aggregation project, while younger farmers participated in the free markets. Similarly, for farmer's experience, the findings displayed that had more experienced farmers were likely to participate in the agricultural aggregation project, whilst younger farmers prefer to sell their commodities in the free markets. This aspect did not show any statistically significant differences among surveyed farmers. Apple producers' level of education had non-significant effect on the proportion of apple sold in the contract farming arrangements. As a result, the socioeconomic variables have insignificant effect on agricultural aggregation project. That is variables age, and education are neglected in the probit model.

The descriptive statistical results showed that the differences in Information costs, negotiation costs, enforcement costs and transportation costs between aggregated producers and non-aggregated producers are statistically significant. The estimation results of the magnitude of each transaction cost-related subtype are illustrated in Table 4.

Transactional costs results in Table 4 showed that the mean time of spent obtaining market price information prior to sell apples was higher in the non-aggregated producers (22.21 days), compared with aggregated producers (18.98 days).

Furthermore, the results indicated that negotiating time to sell products, and time to sorting fruit was high for non-aggregated producers. These findings corroborate with those of [32], who reported that conventional producers expend more time to fix trading price and place than cooperative producers. These results imply that farmers incur costs in terms of negotiation costs as they make trips to buyers' in the traditional spot market and intermediaries. The findings from this study suggest that negotiation costs affect importantly farmers' choices of traditional spot market or contract with aggregator (cold storage warehouses, processing units or packing stations). Agricultural aggregation project help farmers to develop the negotiating skills they needed to deal with time and negotiations (e.g. price negotiation and market demand).

Table 4. Descriptive statistics on farm characteristic, socioeconomic variable and transaction costs.

Transactional costs in aggregated and non-aggregated markets	aggregated n= 120	non-aggregated n= 70	Pooled data N= 190	t/χ2 test
Farm characteristic and socioeconomic variable				
Farm size (ha)	4.04	1.86	2.95	6.89 (0.00)***
Number of apple trees	4884	2442	3663	5.65 (0.00)***
Yield (t ha^{-1})	36.96	24.8	30.88	12.97 (0.00)***
Farm gate price (MAD/kg)	3.74	3.02	3.38	16.28 (0.00)***
Age (years)	53.41	52.86	53.13	0.57(0.563)
Experience (years)	21.03	19.64	20.33	1,24(0.163)
Education (years)	5.93	6.74	6.33	-1.51(0.131)
Transaction costs				
Information costs				
Marke price information (days)	18.98	22.21	20.59	-2.99 (0.00) ***
Potential buyers research (MAD)	784.16	255	519.58	9.81 (0.00) ***
Organization of agricultural events (MAD)	1826.66	519.28	1172.97	6.13 (0.00) ***
Negotiation costs				
Trading price negotiation (days)	10.71	18.42	14.565	-6.79 (0.00) ***
Time to sorting fruit (days)	7.86	10.47	9.165	-3.02 (0.00) ***
Enforcement costs				
Time to wait for the full payment(days)	110	48.85	79.425	16.77 (0.00) **
Expenditure on apple harvest (MAD)	1134.16	766.42	950.29	3.3 (0.03) **
Loss of_buyers' breaking the transaction	377.5	195.14	286.32	5.73 (0.00) ***
Transportation costs				
Damage caused by transportation (MAD)	1195.83	798.57	997.2	2.79 (0.00) ***
Transporting apples to sales (MAD)	1446.5	780.5	1113.5	34.74 (0.00) ***

Note(s): *** and ** indicate significance at 1 and 5% level respectively, χ2 is chi-square, 1 USD = 9.43 MAD

Buyers research results (Table 4) showed that the mean search costs of potential buyers for aggregated producers was significantly higher (784.16 MAD) than in the non-aggregated producers (255 MAD). Noting that the expenditure on organization of agricultural events (MAD) for aggregated producers is also significantly higher (1826.66 MAD) than in the non-aggregated producers (519.28 MAD).

Referring to enforcement cost, the exceptionally advantages of non-aggregated producers were verified. The average payment period in days for apple delivered among agricultural aggregation project was 110 days, while in the traditional spot market, this time was found to be 48 days. This showed that aggregators' buyers took a longer time to pay farmers for apple delivered, but the spot market buyers most cases pay in less than two months. As a non-aggregated, apple producer averagely saved about 367 MAD on apple harvest and 182 MAD on the loss caused by buyer's breaking the transaction. Aggregated producers have to cover the expenditure (1134 MAD) used in feeding the workforce since they directly involved in the process of apple harvest. Whereas non-aggregated producers can avoid a part of this cost, because buyers pay some portion of food costs in the process of apple harvest.

The transportation costs analyzes showed that the differences in damage caused by transportation, and transporting apples to sales between apple producer's members in agricultural aggregation project and non-aggregated members are statistically significant. The results showed that the mean damage caused by transportation in the aggregated producers higher (1195.83 MAD) than in the non-aggregated producers (798.57 MAD) (Table 4). Referring to transporting apples to sales, the results showed that the mean damage caused by transportation in the aggregated producers higher (1446.5

MAD) than in the non-aggregated producers (780.5).

The results showed that the costliest part of transaction for non-aggregated producers is the transportation phase, of which the costs generated are important (798.57 MAD)

4.3 Econometric model results

A binary probit model is employed to estimate the role of transactional costs on the agricultural aggregation project participation. The regression results demonstrate statistically significant relations between aggregated producers and the farm characteristics including farm size, farm gate price, and apple income and apple production. Results of the on farm characteristics and socioeconomic variables are shown in Table 5. The coefficient (B) was negative and significant at 1% level. The negative coefficients suggest that agricultural aggregation project participation is affected in opposite directions by the four variables. The herein reported results are quite similar to those indicated by [32, 33], who found that regression results demonstrate statistically positive relations between producer's AAP participatory decision and the farm characteristics (profitability of the farm) and education levels. This leads to apple producer's members in agricultural aggregation project to better manage farm resources. This is supported by the study conducted by [19] which showed that the farmers who adopt contract farming make the highest revenue from the cotton crop in Tanzania.

Apple yield per unit land area considerably and positively affected farmers' membership in agricultural aggregation project by a probability of 16.2%. This means that knowledge of cultivation methods and technical supervision ensure by aggregator, such as reasonable fertilization, pest control increases productivity and quality standards of the product, thereby increasing apple income by a probability of 5%. This finding is consistent with findings of [8, 34] who found a positive relationship between contract farming and farmers' income. However, they contradict the findings of [35]. Regarding apple transaction price factors, the analysis showed that farm gate price positively affects participation in the agricultural aggregation project by probability 221.9%, hence implying that the aggregator offers a competitive price that leads to increased income per hectare. These findings imply that better prices attract farmers to participate in the agricultural aggregation project. Similar findings have been reported by [36], who reported that the better prices attract farmers to participate in the market. Experience in apple production reduces the proportion of participation in the aggregated market. An increase in experience on production by one year decreases the proportion of apple sold in the agricultural aggregation project by 5%. This indicates that years spent in apple farming have a positive relationship with the proportion sold to the traditional spot market and intermediaries. These findings concur with the results of [36, 37], who reported that the farmers with higher levels of production experience understand the market dynamics.

Table 5. Results of Binary Probit regression models

Dependent Variable: Agricultural aggregation project	B	Exp(B)
Farmer characteristics		
Farm size (Ha)	1.327***	3.771
Number of apple trees	7.513 e^{-5} **	1.000
Yield T Ha^{-1}	.162***	1.176
Farm gate price	2.219***	18.439
Farm income (Ha)	.050***	1.052
Experience	-.050*	.952
Transactional costs		
Information costs		
Marke price information	-.100***	.905
Potential buyers research	-.001***	.999
Organization of agricultural events	.001***	1.001
Negotiation costs		
Trading price negotiation	-.034***	.967
Time to sorting fruit	-.153***	.858
Enforcement costs		
Time to wait for the full payment	.153***	1.054
Expenditure on apple harvest	-.005**	.995
Loss of buyers' breaking the transaction	.002***	1.002
Transportation costs		
Damage caused by transportation	-.001***	.999
Transporting apples to sales	.003***	1.003
Social cost of AAP	.002	1.002
Constant	(-22.998)-23.414***	1.028 e^{-10}

*** Significant at $p < 0.001$; ** significant at $p < 0.01$; * significant at $p < 0.05$.

The findings indicated that the cost of market price information (MPI) reduces the probability of farmer's participation in the agricultural aggregation project by 10%. This cost was captured as the total time spent obtaining market price information prior to sell apples. This is due to the specific role of information and communication technologies in reducing transaction costs in agriculture by enabling timely and affordable communication. Therefore, these results showed that the increased cost of information search decreased the likelihood of participating in the aggregation. These results are similar to those found by [38, 39] who revealed that the information and communication technologies positively affects farmers' participation in agricultural marketing. The findings indicated that the cost of potential buyer's research (PBR) reduces the probability of farmers participation in the aggregation by 0.1%. Therefore, these results showed that the increased cost of finding a suitable buyers decreased the likelihood of participating in the agricultural aggregation projects. It may be that because, in part, of the role of middlemen between the seller of a product and its potential buyers. These results are similar to those found by [40-42], who revealed that intermediaries economize on the cost of transactions and time to look for potential buyers. Organization of agricultural events (OAE) increased the likelihood of participation in the agricultural aggregation project by 0.1%. Apple producers members in agricultural aggregation project spend more cost on agricultural fairs. [32] showed that the larger apple farm scale is, the more producers spend on attending agricultural fairs. The analysis showed that negotiation cost variables such as trading price negotiation (TPN), and time spend sorting fruit before trading with buyers (TSF) negatively affected the agricultural aggregation project participation. This means that all variables related to the negotiation cost are statistically significant. Indeed, an increase in time to price negotiation, and time spend sorting fruit before trading with buyers by 1 day reduces the proportion of agricultural aggregation project participation by 3.4%, and 15.3%, respectively. Similar findings were reported by [8, 23, 43, 44] who have indicated that producers selling directly to market are likely to incur quite different negotiation costs than when selling through a contract arrangements.

Regarding time to wait for the full payment (TFP), the analysis showed that the averagely wait for being fully paid after each transaction in days affected the agricultural aggregation project participation. An increase in to wait for the full payment by 1 day increases the proportion of agricultural aggregation project participation by 15.3%. Although there is a relatively long time postpone to be fully gotten paid, apple producers members in agricultural aggregation project may be accepted this delay due to their highly degree of trust in aggregators. These results are similar to those found by [32, 45, 46], who revealed that the apple producers accepted this delay due to their highly degree of trust in contract farming. The analysis showed that expenditure on apple harvest (EAH) negatively affected the agricultural aggregation project participation. This means that an increase in harvesting cost by 1 unit reduces the proportion of participation in the aggregation project by 0.5%. This cost used in feeding the workforce in the process of apple harvest. Similarly, [32] reported that expenditure on apple harvest reduce the proportion of output sold in the cooperatives. The analysis showed that loss of buyers' breaking the transaction (LBT) negatively affected the proportion of apple sold within the agricultural aggregation project. This means that an increase in buyer's breaking cost by 1 unit reduces the proportion of apple sold in the AAP by 0.2%. Similarly, [32] reported that costs such as loss of buyers' breaking the transaction reduce the proportion of output sold in the cooperatives. The damage caused by transportation (DCT) negatively affected the agricultural aggregation project participation. This means that an increase in proportion of damaged fruit or rotten transporting to the sales sites by 1 unit reduces the proportion of participation in the aggregation project by 0.1%. These results are similar to those found by [32, 47, 48], who revealed that transport costs affect the market participation and also the sales, see [49].

The social cost caused by the implementation of the agricultural aggregation project (SCA) negatively affected the agricultural aggregation project participation. This means that an increase in 1 hectare covered by an aggregation contract reduces the proportion of participants in the aggregation project by 0.2%. This study suggests that social costs have been found to affect project implementation. The importance of social costs reinforces the notion that task management is a method for strengthening the role of the state as guarantor of public services. This finding corresponds with the results of [49].

The project process should therefore not concentrate on the costs actually incurred (charges for implementation, enforcement, and the costs of subsidizing) as perceived in neo-classical economic theories but should also consider the social costs that are not clearly visible in the implementation of the AAP. As a second-order economizing level, it is important for the Moroccan government to establish how such costs can be distributed among the actors involved in each stage of the project cycle. It is on this basis we measure the social costs that are not common in previous studies, thus contributing to the development of literature, and also take other transaction costs for the efficacy of coordination arrangements in Moroccan apple marketing.

5. Conclusion

Contract arrangements play an important role in trade and marketing of agricultural products of many developing countries. While numerous studies have estimated the impact of contract farming on collective marketing adoption, ac-

cess to credit and farm outputs such as crop yields and farm revenue, little attention has been paid to understanding how contract farming affect the transaction costs of agricultural holdings. This study aimed to investigate the transaction cost related influence on vertical coordination in agricultural marketing decision, taking apple producers members in AAP and non-aggregated members as an example. A matched group of aggregation project members and non-aggregated is determined using a propensity score matching technique to mitigate biases stemming from observed variables. The empirical analysis is based on a national representative survey on 190 apple producers in the southeast of Morocco. We compare the transaction costs between farmers aggregated, and non-aggregated through a set of factors identified in the framework of Transaction Costs Theory (TCT) and several other farm characteristics and socioeconomic variables.

The main research findings are summarized as follows. First, although the agricultural aggregation in Morocco is a mechanism for helping farmers to overcome pervasive market failures, vertical coordination is below expectations and has thereby failed farmers in its present form. Second, medium scale apple producers would be beneficial most from being a member in agricultural aggregation compared with the smallholder farmers. The aggregation arrangement is a key determinant of agricultural productivity, and supplementary income to aggregated members. There is a significant relation between aggregated producers and the farm characteristics including farm size, farm gate price, and apple income and apple production. Third, the transaction costs affect importantly farmers' choices of spot market sale or via agricultural aggregation project. Apple producer's non-aggregated members are faced relatively higher transaction costs. High transaction costs (chiefly in terms of information costs, negotiation costs and enforcement costs) borne by Moroccan apple farmers have made many of them enter o contract arrangements to sell their products. On the flip side, the results showed that the time to wait for the full payment, expenditure on agricultural fairs, and expenditure on apple transporting to cold storage warehouses, processing units or packing stations sites are supposed to be shorter, and lower under sales of the apple producers non-aggregated market than that of aggregated ones. The complexity of the project, combined with the numerous actors involved, makes transaction costs unavoidable. Negotiation takes place at every stage of project development and generates substantial hidden costs. Negotiation costs for the project include not only direct costs (e.g. money paid for design offices) but also indirect costs (e.g. degeneration of working relationships, extra resources devoted to conflicts resolution), which may be inconspicuous but considerably costly.

The results in the study imply several policy recommendations. AAP should upgrade their service, thus, aggregators should be encouraged to widen their field of action by putting more emphasis on smallholder farmers' assistance. In addition, the government has to formulate the regulations on eligibility of smallholder farmers for contract negotiations, with a view to protecting the legitimate rights and interests of contracting parties. Policies and regulations considerations of local government department should foster an environment conducive for implementing aggregation projects in the region. Moreover, policy makers should establish a contractual framework to help growers signing a legal contract with purchasers to restrain the opportunism behavior, and thus to minimize the enforcement cost. Government policy makers and the Moroccan federation for fruit trees development in shortly known as FEDAM along with association of apple producers in Midlet and traders as well, need to consider mechanisms for reducing negotiation and monitoring costs borne by farmers, thereby reducing transaction costs. Efforts are also needed to increase apple producer's members in agricultural aggregation project bargaining power. A starting point would be to increase cooperation between the relevant actors, and win-win partnership. Various awareness campaign may be established to broaden the AAP. Such efforts will significantly encourage farmers to choose contract farming arrangements and subsequently will promote the development of a more effective and efficient apple supply chain in Morocco. Benefits resulting from increased vertical coordination in apple sector are evidently many and enormous. For example, the implementation of a contract farming will be able to correct market failure, to assure access to agricultural inputs supplies and markets for smallholder farmers, and to endow farmers with the benefits of operational economy of scale and thus to enhance apple producers' negotiation power, to efficiently and effectively propose solutions to marketing problems.

Agricultural aggregation project is one of the best options to reinforce the vertical coordination in agricultural production, so far, perceived as being the main factor driving rural development and taking advantage of modern techniques of production, financing, and access to internal and external markets. Hopefully, more research efforts will be dedicated toward marketing arrangements in the near future to enhance their efficiency, applicability, and reliability, to reduce transaction costs and reduce the market failure related to the project's high level of risk and uncertainty. In this study, we investigated the scale of the transaction costs in agricultural aggregation projects. Accordingly, we concluded that despite a few drawbacks agricultural aggregation project is one of the vertical coordination modes' most promising contract arrangements to meet the future agricultural markets demand.

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References

[1] Akesbi, N. (2014). Which agricultural policy for which food security in Morocco? In Seasonal Workers in Mediterranean Agriculture (pp. 185-192). Routledge.

[2] El Houssain, B.; Fadlaoui, A.; Allali, K.; Arrach, R. Contract Farming in the Morocco Cereal Sector: Contract Clauses, Ambiguity, and Opportunism. Int. J. Agric. Econ. 2019, 4, 245.

[3] Bouichou, E. H., Abdoulaye, T., Allali, K., Bouayad, A., & Fadlaoui, A. (2021). Entrepreneurial intention among rural youth in Moroccan Agricultural Cooperatives: the future of rural entrepreneurship. Sustainability, 13(16), 9247.

[4] Abdulai, Y., & Al-hassan, S. (2016). Effects of Contract Farming On Small-Holder Soybean Farmers' Income in the Eastern Corridor of the Northern Region, Ghana.

[5] Mulatu, G., Haji, J., Legesse, B., & Ketema, M. (2017). Impact of participation in vegetables' contract farming on household's income in the Central Rift valley of Ethiopia. American Journal of Rural Development, 5(4), 90-96.

[6] Pan, W., & Bai, H. (2018). Propensity score methods for causal inference: an overview. Behaviormetrika, 45(2), 317-334.

[7] Coase, R. (1952). H., 1937, The Nature of the Firm. Economica, 4(16), 386405.

[8] Ray, N., Clarke, G., & Waley, P. (2021). The impact of contract farming on the welfare and livelihoods of farmers: A village case study from West Bengal. Journal of Rural Studies, 86, 127-135.

[9] Coase, R. H. (1990). Accounting and the theory of the firm. Journal of Accounting and Economics, 12(1-3), 3-13.

[10] Riordan, M. H., & Williamson, O. E. (1985). Asset specificity and economic organization. International Journal of Industrial Organization, 3(4), 365-378.

[11] Frank, S. D., & Henderson, D. R. (1992). Transaction costs as determinants of vertical coordination in the US food industries. American Journal of Agricultural Economics, 74(4), 941-950.

[12] Williamson, O. E. (1973). Markets and hierarchies: some elementary considerations. The American economic review, 63(2), 316-325.

[13] Januszewski Forbes, S., & Lederman, M. (2009). Adaptation and vertical integration in the airline industry. American Economic Review, 99(5), 1831-49.

[14] Léger-Bosch, C. (2019). Farmland tenure and transaction costs: Public and collectively owned land vs conventional coordination mechanisms in France. Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie, 67(3), 283-301.

[15] Simshauser. (2021). Vertical integration, peaking plant commitments and the role of credit quality in energy-only markets. Energy Economics, 104, 105612. 63(2), 316-325.

[16] Royer, A. (2011). Transaction costs in milk marketing: A comparison between Canada and Great Britain. Agricultural Economics, 42(2), 171-182.

[17] Coulter, J., Goodland, A., Tallontire, A., & Stringfellow, R. (1999). Marrying farmer cooperation and contract farming for service provision in a liberalising sub-Saharan Africa. Natural resource perspectives, 48, 1-4.

[18] Bijman, J. (2008). Contract farming in developing countries: an overview.

[19] Nsimbila, P. M. (2021). Determinants of Contract Farming Adoption and its Impact on Productivity of Smallholder Cotton Producers in Tanzania. International Journal of Social and Administrative Sciences, 6(2), 55-69.

[20] Williamson, O. E. (1979). Transaction-cost economics: the governance of contractual relations. The journal of Law and Economics, 22(2), 233-261.

[21] Williamson, O. E. (1989). Transaction cost economics. Handbook of industrial organization, 1, 135-182

[22] Bwalya, R., Mugisha, J., & Hyuha, T. (2013). Transaction costs and smallholder household access to maize markets in Zambia. Journal of Development and Agricultural Economics, 5(9), 328-336.

[23] Hobbs, J. E. (1997). Measuring the importance of transaction costs in cattle marketing. American Journal of Agricultural Economics, 79(4), 1083-1095.

[24] Haut-Commissariat au Plan Maroc, "Présentation de la région Draa https://www.hcp.ma/draa-tafilalet/Presentation-de-la-region-de-Draa-Tafilalet_a4.html, accessed on 5 November 2021.

[25] Valentová, M., Lízal, L., & Knápek, J. (2018). Designing energy efficiency subsidy programmes: The factors of transaction costs. Energy Policy, 120, 382-391.

[26] Zhao, Z. (2008). Sensitivity of propensity score methods to the specifications. Economics Letters, 98(3), 309-319.

[27] Maertens, M., & Velde, K. V. (2017). Contract farming in staple food chains: The case of rice in Benin. World Development, 95, 73-87.

[28] D'Alberto, R., Zavalloni, M., Raggi, M., & Viaggi, D. (2018). AES impact evaluation with integrated farm data: Combining statistical matching and propensity score matching. Sustainability, 10(11), 4320.

[29] Gershon, O., Matthew, O., Osuagwu, E., Osabohien, R., Ekhator-Mobayode, U. E., & Osabuohien, E. (2020). Household access to agricultural credit and agricultural production in Nigeria: A propensity score matching model. South African Journal of Economic and Management Sciences, 23(1), 1-11.

[30] Pufahl, A., & Weiss, C. (2007). Evaluating the effects of farm programs: Results from propensity score.

[31] Alwarritzi, W., Nanseki, T., & Chomei, Y. (2016). Impact of oil palm expansion on farmers' crop income and poverty reduction in Indonesia: An application of propensity score matching. J Agric Sci, 8(1), 119-31.

[32] Lijia, W., & Xuexi, H. (2014). Transaction costs comparison between cooperatives and conventional apple producers: A case study of Northwestern China. Annals of Public and Cooperative Economics, 85(2), 233-255.

[33] Gujarati, D. N., Porter, D. C., & Gunasekar, S. (2012). Basic econometrics. Tata mcgraw-hill education.

[34] Miyata, S., Minot, N., & Hu, D. (2009). Impact of contract farming on income: linking small farmers, packers, and supermarkets in China. World development, 37(11), 1781-1790.

[35] Khan, M. F., Nakano, Y., & Kurosaki, T. (2019). Impact of contract farming on land productivity and income of maize and potato growers in Pakistan. Food Policy, 85, 28-39.

[36] Karing'u, K. N., Isaboke, H. N., & Ndirangu, S. N. (2020). Transaction costs and participation in avocado export marketing in Murang'a County, Kenya. Journal of Agribusiness in Developing and Emerging Economies.

[37] Adepoju, A.O., Oyegoke, O., and Amusan, A. (2019). "Productivity and market participation of Fluted pumpkin farmers under tropical conditions", International Journal of Vegetable Science, pp. 1-10.

[38] Minkoua Nzie, J. R., Bidogeza, J. C., & Azinwi Ngum, N. (2018). Mobile phone use, transaction costs, and price: Evidence from rural vegetable farmers in Cameroon. Journal of African Business, 19(3), 323-342.

[39] Ton, G., Vellema, W., Desiere, S., Weituschat, S., & D'Haese, M. (2018). Contract farming for improving smallholder incomes: What can we learn from effectiveness studies? World Development, 104, 46-64.

[40] Jagwe, J. N., & Machethe, C. (2011). Effects of transaction costs on choice of selling point: a case of smallholder banana growers in the Great Lakes region of Central Africa. Agrekon, 50(3), 109-123.

[41] Mabuza, M. L., Ortmann, G., & Wale, E. (2014). Effects of transaction costs on mushroom producers' choice of marketing channels: implications for access to agricultural markets in Swaziland. South African Journal of Economic and Management Sciences, 17(2), 207-219.

[42] Chowdhury, S. K. (2002, August). Access to information, transaction costs and marketing choice of rural households between middlemen and direct buyers in Bangladesh. In Royal Economic Society Annual Conference 2002 (No. 50). Royal Economic Society.

[43] Ba, H. A., de Mey, Y., Thoron, S., & Demont, M. (2019). Inclusiveness of contract farming along the vertical coordination continuum: Evidence from the Vietnamese rice sector. Land use policy, 87, 104050.

[44] Ren, Y., Peng, Y., Campos, B. C., & Li, H. (2021). The effect of contract farming on the environmentally sustainable production of rice in China. Sustainable Production and Consumption, 28, 1381-1395.

[45] Zhong, Z., Zhang, C., Jia, F., & Bijman, J. (2018). Vertical coordination and cooperative member benefits: Case studies of four dairy farmers' cooperatives in China. Journal of Cleaner Production, 172, 2266-2277.

[46] Guo, H., Jolly, R. W., & Zhu, J. (2007). Contract farming in China: perspectives of farm households and agribusiness firms. Comparative Economic Studies, 49(2), 285-312.

[47] Macharia, M. A., Mshenga, P. M., Ngigi, M., Gido, O. E., & Kiprop, K. J. (2014). Effect of transaction costs on smallholder maize market participation: Case of Kwanza District, Trans Nzoia County, Kenya. International Journal of Development and Sustainability, 3(4), 715-725.

[48] Ma, W., Renwick, A., Yuan, P., & Ratna, N. (2018). Agricultural cooperative membership and technical efficiency of apple farmers in China: An analysis accounting for selectivity bias. Food Policy, 81, 122-132.

[49] Osebeyo, S. O., & Aye, G. C. (2014). Transaction costs and marketing decision: a case study of smallholder tomato farmers in Makurdi, Nigeria. Urban, Planning and Transport Research, 2(1), 333-340.