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Dual moral hazard and adverse selection in South African agribusiness: it takes two to tango

RESEARCH ARTICLE

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Abstract

The paper employs a dual moral hazard and adverse selection model to analyse partnerships in agribusiness under joint venture contracts with asymmetric information and imperfect quality measurement by the agent and principal both of which contribute to the final quality of the product in terms of production effort and marketing (offtake) effort, respectively. A salient feature of this paper is the analysis of the ramifications of joint venture contract for quantity and quality, which is often deficient in most previous analyses of moral hazard. The research found that contracts that have rewards based on the quantity produced weakened the agent's incentive to make effort in ensuring quality. This finding could explain why most contracts in agriculture for products with differentiated markets rarely use retail-price conditioned contracts.

Keywords: joint venture, agribusiness, moral hazard, Africa

JEL code: C65, Q13, Q15, Q18

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1. Introduction

The agribusiness (agrifood) system has been undergoing fundamental change that is transforming traditional marketing relationships in response to changing consumer needs. The agribusiness supply chains and networks which were once characterised by autonomous and independent actors are rapidly becoming more globally interconnected with a wide array of complex relationships (Cook and Chaddad, 2000; Machethe *et al.*, 1997; Ruben *et al.*, 2006).

In Africa, agribusiness is a burgeoning sector of local economies and continental economy. The sector has been receiving unprecedented attention from policy makers and private sector investors alike with increasing favourable policy interventions and private capital investments from both large multinational food and agribusiness companies and up and coming local food companies (World Bank, 2013). Governments in Africa have been devoting much effort and resources to creating an environment conducive to the take-off and success of agribusiness sector. The World Bank (2013) further purports that if the increased attention received by African agriculture and agribusiness were to be matched with more electricity, irrigation, smart business and trade policies and a dynamic private sector that works hand in hand with governments to link small-scale farmers with consumers in an ever-urbanizing Africa, the sector could contribute US\$1 trillion by 2030.

In economics, moral hazard occurs when one person takes more risks because someone else bears the cost of those risks. A moral hazard may occur where the actions of one party may change to the detriment of another after a financial transaction has taken place. Moral hazard and adverse selection are often used interchangeably although, strictly speaking, they are not synonymous. On the one hand, adverse selection occurs when there is lack of symmetric information prior to a deal between a buyer and a seller. On the other hand, moral hazard occurs when there is asymmetric information between two parties and when change in the behaviour of one party occurs after a deal is struck. Both expressions are used to describe situations where one party is at a disadvantage compared to the other.

There is no doubt that trade liberalization and globalization have brought about stringent sanitary and phytosanitary requirements and this is attested to by both experience and an ever-growing body of research and published work (Henson and Loader, 2001; Otsuki *et al.*, 2001; Ruben *et al.*, 2006). These stringent quality requirements present complications and non-tariff barriers to entry for farmers and agribusinesses in fresh produce both for local and export markets. These hindrances have been described as emerging barriers to agricultural and food trade (Ruben *et al.*, 2006). The afore-mentioned developments exert additional demands on producers and processors of fresh produce to meet high and uniform quality standards and frequent delivery requirements (Reardon *et al.*, 1999). Sourcing of perishable produce to secure all-year round supply, under private label, can be guaranteed through partnerships and long-term contracts between primary producers (farmers) and processors.

Joint ventures in the agrifood chains are seen as an innovative response to emerging developments in the industry. These trends are brought about by the ever-evolving consumer demands and the concomitant quality requirements as identified through supply-chain analyses to understand market structure and performance. Supply chains are understood as transformation processes from inputs through primary production, processing and marketing to the final consumer (Porter, 1990). These transformation processes involve three dimensions: (1) organizational systems for the coordination amongst agents; (2) knowledge systems for combining information, skills and technologies; and (3) economic mechanisms for product and technology selection and for providing market access. Thus, supply chain performance can be assessed with efficiency parameters, searching for specialization according to comparative advantage and towards integration for reducing transaction costs. However, trust is an indispensable ingredient for joint ventures and other forms of partnership to succeed. According to Newman and Biggeman (2016), trust is an integral part of maintaining any successful business relationship, especially within agriculture and trust is required for any transaction to

take place. Trust is the cohesion in agricultural transactions which creates the value of relationships between transacting parties (Wilson, 2000).

In 2001 Lazzarini *et al.* (2001) introduced the concept of netchains at the interface of vertical supply chains and horizontal networks. According to Lazzarini *et al.* (2001), netchains can be viewed as a multi-layer hierarchy between suppliers, processors and retailers where horizontal coordination between reciprocal agents is embedded in a framework of vertical deliveries as indicated in Figure 1. It is worth reiterating that the agricultural and food sector is facing ever-evolving and stringent quality requirements. Horizontal cooperation (such as in farmers cooperatives) may present one of the best approaches to better cope with the stringent quality criteria and changing quantity demands emerging from chain partners. Figure 1 illustrates a typical supply chain in the agrifood industry. It can clearly be seen from the Figure 1 that relationships are indispensable in the agrifood sector if one is to survive and remain in business. Furthermore, the relationships are interconnected and multi-facet in nature thus information is shared amongst more than two stakeholders. This web of relationships further buttresses the need for partnerships in order to be integrated along the value chain. By implication, messing relationships with one partner or role-player could have telling repercussions for one within the sector.

The Lazzarini *et al.* (2001) netchains provide linkages between horizontal networks of suppliers and vertical supply chains. Netchains involve different types of interdependencies (nested) amongst agents, for example: (1) reciprocal cooperation based on mutual exchange between suppliers; (2) sequential delivery systems based on planning along the supply chain; and (3) pooled interdependencies at business level to guarantee standardisation and harmonisation of produce and processes.

Finally, the role of formalisation of relationships amongst the various role-players cannot be ignored. Thus, contracts have a vital function in the relationships between chain and networks partners. Contracts define the rules and obligations of engagement for establishing cooperation between both network and chain agents. Contracts can be viewed as a cost-reducing mechanism in the case of repeated transactions between agents. Self-enforcing contracts that involve trust and loyalty are preferred for transactions that involve the delivery of high quality products to reduce monitoring and enforcement costs (Ruben *et al.*, 2006:7; Shaban, 1987).

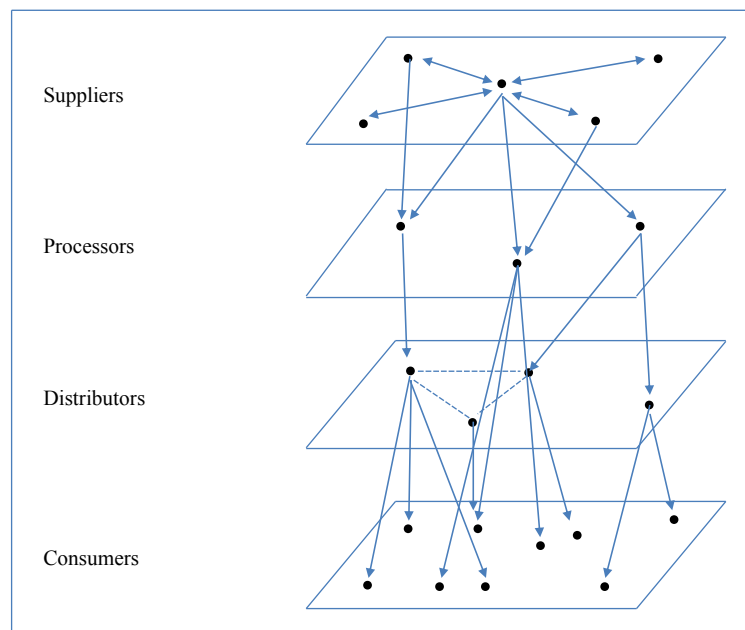


Figure 1. An illustration of supply chain in the agrifood sector (adapted from Lazzarini *et al.*, 2001).

There is a plethora of available options for integrating horizontal networks and vertical chain contracts in order to guarantee risk-sharing and ensuring trust relationships (Masuku *et al.*, 2007). Due to the inherent high risks, complexities and difficulties of monitoring numerous heterogeneous agents, entire-channel process control is increasingly preferred (Goodhue, 1999; Janssen and Van Tilburg, 1997; Van der Laan, 1993). Most of these entire-channel process control approaches are forms of self-enforcing contracts in order to obviate the need for stringent monitoring by the principal (Hardaker *et al.*, 2015; Kvaløy, 2006).

On the one hand, market access for farmers is one of the most binding constraints to agricultural development and commercialisation of small- to medium-scale farmers the world over and South Africa is no exception. Farmers are increasingly interested in being vertically integrated along the value chain in order to maximise profit through beneficiation of their produce beyond the farm gate. It should also be noted that farmers, being rational business people, are always looking for better business opportunities that maximize their utility while balancing their risk portfolios. On the other hand, agro-processors and other agribusinesses are always looking for agricultural produce (raw products) in sufficient quantities and of the required quality to be supplied consistently. The desire by agribusinesses to control the supply of raw materials has led to increased vertical coordination in the food market. Thus, the food market might be thought of as an orchestra with each level of the market contributing its utility to the final product (Kohls and Uhl, 1998:211). The problem then becomes how to marry the objectives of these two players in the agribusiness value chain and create a mutually beneficial working arrangement.

In South Africa, as in the rest of the African continent, commercial agricultural production has been dominated by few large-scale commercial farmers who are vertically integrated into the food and input (agribusiness) value chain through their membership in cooperatives. Thus, the bulk of agricultural product, especially in South Africa, is from the few large-scale commercial farmers in the face of a large number of small-scale farmers who contribute disproportionately small quantities of agricultural product into the market. This has led to the dualistic nature of the South African agricultural sector. Policy makers and the South African government have attempted to address this dichotomous sector through instituting a land reform programme which seeks to redress imbalances of the past through land restitution and land redistribution¹. The land reform programme has brought about a number of new commercial farmers who had been alienated from commercial agriculture thus have limited connections within the market. Furthermore, most these new farmers have a paucity of technical agriculture skills, little or no capital and limited access to credit due lack of collateral and credit track record required by financial institutions.

A number of partnerships between farmers and agribusinesses have been established in South Africa, especially since the land reform programme started in the 1990s. The partnerships that exist are varied in their nature but mostly would be categorized as either strategic partnerships, joint venture partnerships or contract farming. Strategic partnership refers to an arrangement where an experienced farmer is assigned to assist relatively inexperienced farmers (mostly land reform beneficiaries) as a mentor. This model of partnership is often referred to as 'the mentorship programme' in South African agricultural and land reform parlance. There is growing evidence that there is no ideal model as each case is different thus there is no one size fits. The success of partnerships between farmers and agribusinesses has also been somewhat mixed (Terblanche *et al.*, 2014). This study focuses on joint venture partnership between land reform beneficiaries and agribusiness in South Africa, using the province of KwaZulu-Natal as a case study.

The analysis presented in this research work explains an apparent anomaly frequently observed on many agricultural contracts which manifest itself in the principal's use of seemingly uniform contracts for the purposes of governing the relationships with heterogeneous agents. Previous work on adverse selection in a similar environment to the study being reported in this paper has been done by Leegomonchai and Vukina (2005). In their work they tested whether chicken companies allocated production inputs of varying quality

¹ Land restitution is aimed at restoring land ownership to indigenous communities who were dispossessed of their land during colonialization and apartheid. Land redistribution seeks to give more land ownership to previously disadvantaged people through the distribution of state land and purchase of private land through a willing seller willing buyer principle.

by providing high ability agents with high quality inputs or by providing low ability agents with high quality inputs. The first strategy of providing high quality inputs to high ability agents is meant to stimulate the career concerns type of response on the part of the growers (agents), whereas the second strategy would generate a ratchet effect. Leegomonchai and Vikuna (2005) found no significant input discrimination based on grower abilities that would lead to either career concerns or ratchet effect type of dynamic incentives.

Empirical tests of contract theory are typically done with either cross-industry and cross-firm data or intra-firm data. The first approach of using cross-industry or cross-firm data can provide more generalizable empirical results but faces the econometric problem of unobserved heterogeneity (Chiappori and Salanié, 2003). The second approach of using intra-firm data will generate specific results that are difficult to generalize but has the advantage of dealing with agents that operate in the same environment, thus drastically reducing the potential of unobserved heterogeneity that is rife under the first approach. The research being reported in this paper belongs to the second category of studies. The data come from records of companies that contract the production of fresh produce (vegetables) with independent farmers.

The main objective of the research was to identify and quantify moral hazards and adverse selection in selected farmer/agribusiness partnerships in KwaZulu-Natal. Subsidiary objectives were to develop and refine methodology for measuring dual moral hazard and to recommend approaches to ameliorating moral hazard and adverse selection in joint venture partnerships in agribusiness.

2. Conceptual framework

The development of the theory of incentives has been a major advance of economics in the last forty years. Conflicting objectives and decentralized information are the two basic ingredients of incentive theory. That economic agents pursue at least to some extent their private interests is the essential paradigm for the analysis of market behaviour by economists. What is proposed by incentive theory is to maintain this major assumption in the analysis of organizations, small number of markets and any other kinds of collective decision.

The tenant of incentive theory therefore is tantamount to the problem of delegation of a task to an agent with private information. This private information can be of two types: either the agent can take an action unobserved by the principal, the case of moral hazard or hidden action; or the agent has some private knowledge about his/her cost or valuation that is ignored by the principal, the case of adverse selection or hidden knowledge. The theory studies when this private information is a problem for the principal, and what is the optimal way for the principal to cope with it. Another type of information problem has also been raised in the literature, the case of non-verifiability where the principal and the agent share ex post the same information but no third party and, in particular, no Court of Law can observe this information (Aghion and Bolton, 1987). One can study to which extent the non-verifiability of information is also problematic for contractual design.

3. Methodology

Relationships between agribusiness firms and farmers often focus on the fundamental asymmetry of information between principals (agribusinesses), and agents (farmers). The key variable that is only partially revealed to agribusinesses by primary producers is the amount of effort the farmers put forth in trying to achieve production objectives. Agribusinesses' net income, or, in the case of cooperatives, farming trusts or community property associations, total net benefit rises in farmers' effort, but falls in farmers compensation. Farmers' rewards are assumed to be proportional to the total amount of benefits (effort) that they create, so the problem from the agribusinesses' perspective is to choose an incentive plan that implements the optimal amount of effort from farmers in order to maximize total net benefits (Grossman and Hart, 1983).

$$\bar{Q} = f(S, P) = \lambda_1 \bar{S} - \lambda_2 P \quad \text{with } \lambda_1 > 0, \lambda_2 > 0 \quad (1)$$

From (1), the inverse demand function facing the processor i is given by:

$$P = f(\bar{S}, \bar{Q}) = a\bar{S} - b_1\bar{Q} \text{ with } a = \lambda_1 / \lambda_2, b = 1 / \lambda_2 \quad (2)$$

The cost function: In economics, any choice between two or more activities comes at a cost and this is normally referred to as opportunity cost. The opportunity cost principle holds true for the demand function facing the processor. There is a cost associated with each effort because it is unpleasant and forgoes the opportunity to undertake other activities. Input production costs, c , are a function of the efforts in quantity and quality. As is traditionally the case in models of this kind, we assume marginal production costs regardless of quantity effort volume and quadratic in line with the given level of quality effort (Equation 7):

$$c = c_1 \frac{qs^2}{2} \text{ with } c_1 > 0 \quad (3)$$

And similar to the models of franchise, we assume that the private cost of effort for the processor is the same as for the grower. Then, the processor's cost, C , will be:

$$C = c_1 \frac{Qs^2}{2} \text{ with } c_1 > 0 \quad (4)$$

3.1 The double moral hazard model

The principal-agent theory postulates that when the risk-averse agent faces a trade-off between the provision of incentives and risk sharing, an outcome-conditioned sharing contract can be a second-best pay scheme (Holmström and Milgrom, 1987; Stiglitz, 1974). This tenant of the principal-agent theory implies a dual compensation scheme, w , consisting of (1) a fixed payment, α , that is independent of the observed outcome, and (2) an incentive payment that equates to a positive share, β , of the publicly observable outcome:

$$w = \alpha + \beta xP \quad (5)$$

In this model, revenue is the performance indicator as it has been shown by (Rubin, 1978) that when the principal has a greater potential to impact on retail demand through branding revenue sharing contracts are better instruments to provide appropriate incentives than profit sharing contracts.

In most cases the principal also provides some effort which invariably affects the outcome thus the incentive provision for both the agent's action and the principal's own effort level must be recognized in designing the agent's incentive scheme. In this regard, the processor chooses the parameters of the incentive scheme, α and β , to maximize her/his expected profit subject to the constraints that both processor and agent choose individually their efforts to maximize their certainty equivalent and the grower attains at least his/her reservation utility, \bar{U}_p , such that:

$$\text{Max}_{\alpha, \beta} CE^{\text{Processor}} = (1 - \beta)QP - C - \alpha \quad (6)$$

$$\text{Max}_{q, s} CE^{1^{\text{st}} \text{ Processor}} = \alpha + \beta QP - c - \frac{\rho}{2} \sigma_{\beta QP}^2 \quad (7)$$

(Grower's incentive compatibility constraint)

$$\alpha + \beta QP - c - \frac{\rho}{2} \sigma_{\beta QP}^2 \geq U_{\min} \quad (8)$$

(Grower's reservation constraint)

$$MaxCE_b^{Processor} = (1 - \beta)QP - C - \alpha \quad (9)$$

(Processor's incentive compatibility constraint)

The optimization problem is sequentially in Equation 6-9. First, the effort choice made by the processor is determined:

$$\frac{MaxCE_b^{Processor}}{b} = (1 - \beta)Q(a(\theta b + s) - c_1 \frac{Qb^2}{2} - \alpha \quad (10)$$

The optimal solution to the processor's decision of effort Equation 10 is:

$$\frac{ACE_b^{Processor}}{\partial b} = (1 - \beta)Qa\theta - c_1Qb = 0 \rightarrow b = \frac{(1 - \beta)a\theta}{c_1} \quad (11)$$

Second, given the processor's choice, the efforts in quantity and quality that maximize the grower's certainty equivalent are determined:

$$MaxCE_{q,s}^{1st Producer} = \alpha + \beta Q(a(\theta b + s) - b_1 Q) - c_1 \frac{Qs^2}{2} - \frac{\rho}{2} \beta^2 Q^2 a^2 s^2 \sigma_s^2 \quad (12)$$

The first-order necessary conditions for maximizing Equation 12 with respect to q and s yield:

$$\frac{\partial CE_{1st Producer}}{\partial q} = \beta(a(\theta b + s) - 2b_1 q) - c_1 \frac{s^2}{2} - \rho \beta^2 q a^2 s^2 \sigma_s^2 = 0 \quad (13)$$

$$\frac{\partial CE_{1st Producer}}{\partial s} = \beta q a - c_1 q s - \rho \beta^2 q^2 a^2 s \sigma_s^2 = 0 \quad (14)$$

The reaction functions derived from the maximization problems thus defined are:

$$q = \frac{\beta(a(\theta b + s)) - c_1 \frac{s^2}{2}}{\beta(2b_1 + \rho \beta a^2 s^2 \sigma_s^2)} \quad (15)$$

$$s = \frac{\beta a}{c_1 + \rho \beta^2 q a^2 \sigma_s^2} \quad (16)$$

Substituting the previous expressions, $q=f(\beta)$ and $s=f(\beta)$, into Equation 6 and 8 and choosing α and β , Kuhn-Tucker conditions reveal a boundary solution with $CE^{1st Producer}=U_{min}$, in Equation 8 implying:

$$\alpha = -\beta QP + c + \frac{\rho}{2} \sigma_{BQP}^2 + U_{min} \quad (17)$$

Finally substituting Equation 17, $b=f(\beta)$, $q=f(\beta)$ and $s=f(\beta)$ into Equation 6 and maximizing with respect to β , the value of β optimal may be obtained.

It should be stated ab initio that the principal-agent model defined in Equation 1 has been widely used to analyse numerous issues in economics, including in agriculture (Just and Pope, 2002; Richards *et al.*, 1998; Viaggi *et al.*, 2009). Despite the widespread use of the principal-agent model in analysing partnerships such as share-cropping contract, contract farming and joint venture, explicitly solving the first conditions that define the decision variables in the contract remains largely elusive. The afore-mentioned difficulty and paucity of empirical studies on principal-agent model notwithstanding, the importance of quantitative approaches to

analyse the phenomena of moral hazard and adverse selection in real life cases remains indispensable thus the ability to generate numerical data is a key step in solving this conundrum.

This section attempts to model double moral hazard using a range of observations as scenarios from 12 selected cases of joint ventures and contract farming contracts in KwaZulu-Natal, South Africa. The observations were derived from experiences of working with these 12 cases over a period of four years and continuous engagements with principals and agents involved. The engagements included prolonged facilitation of negotiations between the principals and agents on issues of the pricing mechanisms for the products and the accrual of dividends. The qualitative data derived from field were analysed through Mathematica (Wolfram Research, Inc., 2016) to solve the model as outlined in the methodology section and to produce quantitative data. The data produced by Mathematica were then used in Matlab (The MathWorks, Inc., 2012) to draw the planes depicting the most suitable representation of the behaviours of both the principal and agent. After several iterations of running the model through Mathematica, the following parameters were chosen: $\alpha=1$, $b_1=0.00001$ and $c_1=1$. It should be noted that it is important to calibrate the model first before settling on the parameters to be used based on the observations collected from the cases being studied.

A vital feature of this research work is capturing the effect of the principal's effort on quality of produce. Thus the effort – quality relationship was amended to include both the grower's effort (agent) and the processor's effort (principal) as follows: $\bar{S}=\theta b=\bar{s}$, where parameter $\theta>0$ is a proxy for the importance of the principal's effort. Therefore, there are three free parameters in the model, i.e. the processor's efficiency factor (θ); the grower's coefficient of absolute risk aversion (ρ); and the variance of input quality (σ_s^2). The latter two parameters can be jointly identified as $\rho\sigma_s^2$, since both parameters act on the producer's risk premium in a similar manner. A free parameter is a variable in a mathematical model which cannot be predicted precisely or constrained by the model and must be estimated experimentally or theoretically and is a variable that can be adjusted to make the model fit the data (Calvert *et al.*, 2004; Kline, 2015).

Scenarios were used in the analyses and presentation of the results. The first to be considered is a scenario in which the agent is risk-neutral.

4. Results

4.1 Scenario 1: risk-neutral agent and principal

The first step of the analysis was to compute the solution to the agency problem assuming risk neutral agents. A wide range of 0 to 0.9 in intervals of 0.1 for the efficiency factor θ was considered.

Figure 2 shows how the share of the outcome, β , varies as a function of the importance of the principal's effort, θ . The results are consistent with the postulations of the agency theory (Bamberg and Spremann, 1989; Eisenhardt, 1989; Fama, 1980), the value of β is at its maximum at when the processor has no interest in the quality of the produce and its value is 1, implying that the agent receives all the revenue accruing from the sale of the produce. Similarly, and congruent to the predictions of franchise models, the share of the outcome β is decreasing in θ . This finding resonates with the findings of other previous studies elsewhere such as Lafontaine (1992) and Holmström and Milgrom (1991). The finding which is also collaborated by others is that when the franchisor inputs are more important, less vertical separation is observed, as predicted.

The results pertaining to the importance of the grower's effort are shown in Figure 2. Figure 3 clearly shows a positive relationship between the grower's effort in quantity and the principal's effort. Thus, the grower's effort in quantity varies as the importance of the principal's effort increases. The intervals of θ range from 0 to 0.9. The quantity input curve appears smooth, gradual and somewhat concave with a minimum of $\theta=0.5$.

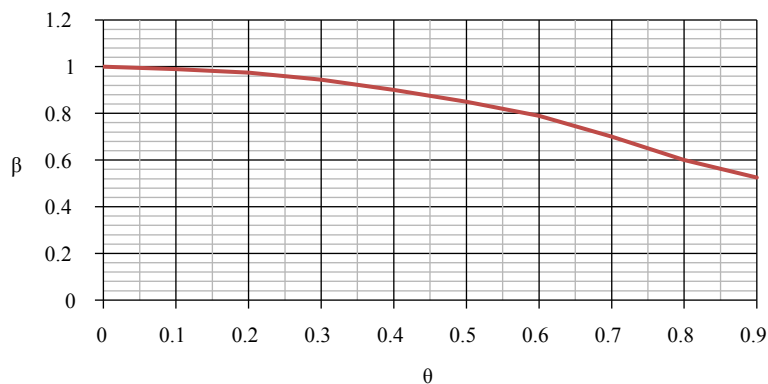


Figure 2. The share of the outcome (β).

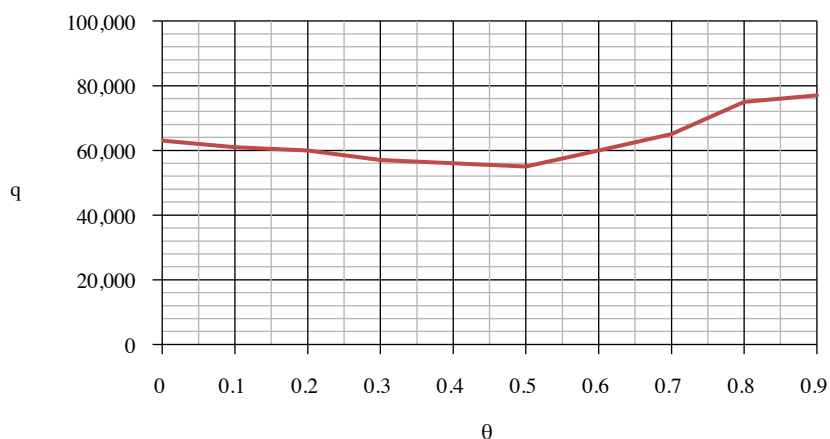


Figure 3. Quantity input (q).

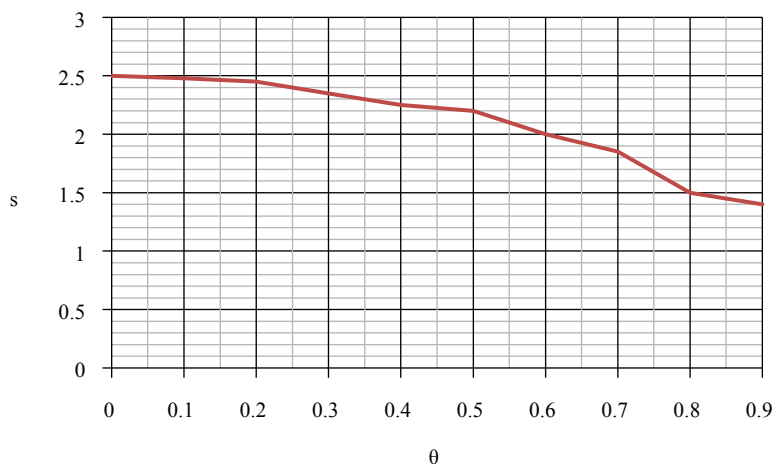


Figure 4. Expected input quality (s).

The results of the quality efforts of both the agent and the principal are shown in Figure 4 and 5, respectively. Considering the shapes of the efforts curves as a function of the efficiency factor, θ , gives useful insights into the relationship between the quality efforts of both the agent and principal. Interestingly, the results show that when the processor's puts more importance on the quality of the produce, the grower expends less effort. This finding is counter intuitive but is indicative of the problem of moral hazard and invokes the

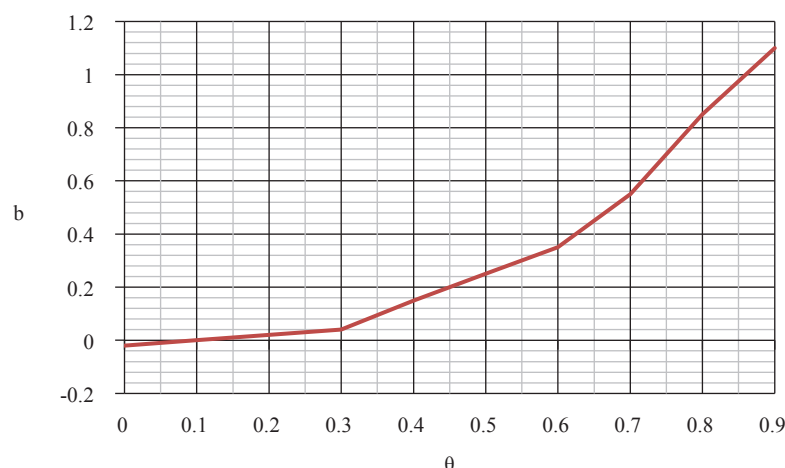


Figure 5. Processor's effort.

principle of free-riding as the grower now depends more on the effort of the processor. Contrariwise, the processor's effort in ensuring acceptable quality is increasing in θ , as it can be deduced from Equation 10.

4.2 Scenario 2: risk-averse agent and risk-neutral principal

In order to model this risk-averse agent and risk-neutral principal, the parameter estimates were obtained by searching over an equi-distance spaced grid of 100 values for each and every parameter ranging from 0 to 0.9 for θ and 0 to 0.00009 for $\rho\sigma_s^2$.

Figure 6 shows that as the producer's risk premium ($\rho\sigma_s^2$), that is risk aversion or quality variance, increases, given the value of the θ , the share of the outcome, β , decreases.

This finding is collaborated by the postulation of the principal-agent framework with risk-averse agents as discussed by Holmström and Milgrom (1991). The Holmström and Milgrom (1991) model states that: If one individual has more than two tasks to perform and performance of a task is not well measurable, the

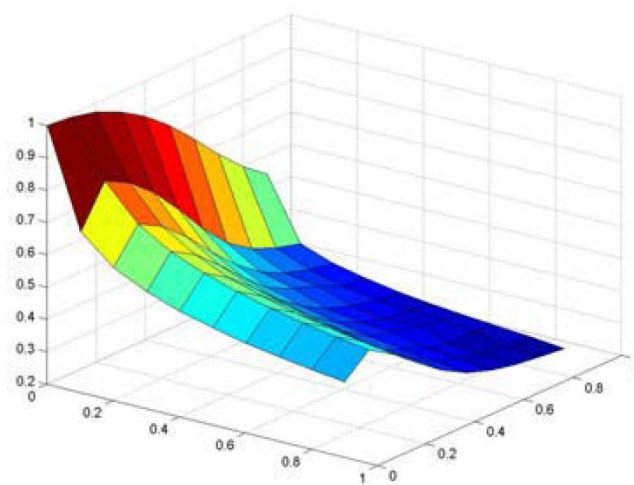


Figure 6. The share of the outcome (β).

implementation of incentives lead to a misallocation of effort. The individual will concentrate on that task for s/he receives the strongest incentives.

The principal-agent theory as discussed in Holmström (1979) offers the canonical model including a hidden one-shot action taken by an agent contracted to provide effort. Furthermore, Holmström and Milgrom (1987) were able to provide proof of the optimality of linear reward schemes². The sequence-of-actions model has a corresponding (static), highly tractable companion (Lundesgaard, 2001).

In general, an increase in the importance of the principal's effort, given the value of the agent's risk premium, will decrease the incidence of β . However, this result is not robust when the efficiency factor converges to zero, in which case the value of β increases. Similarly, Figure 7 depicts the behaviour of the input quantity as a function of the efficiency factor, θ , and risk premium, $\rho\sigma_s^2$. When the efficiency factor (θ) converges to zero, an increase in the risk premium ($\rho\sigma_s^2$) will decrease the grower's effort in quantity. Conversely, when the efficiency factor (θ) increases above zero, the input quantity increases and furthermore the negative incidence of an increase in the risk premium ($\rho\sigma_s^2$) on input quantity declines.

The quality efforts of both the agent and principal are represented in Figure 8 and 9, respectively. Taking a cursory look at both figures leads one to clearly deduce that in most cases, as represented by the observations in this study, the quality efforts of the agent and principal are divergent in that they vary in opposite directions. Simply put, when the efficiency factor (θ) and/or the risk premium ($\rho\sigma_s^2$) increase, the processor's effort increases; on the contrary, the primary producer's effort in quality decreases. A departure from the general trend observed was when the efficiency factor (θ) converged to zero, in which case both the agent and principal's efforts increased as the risk premium ($\rho\sigma_s^2$) increased.

² In the one-shot model, reward schemes are never linear.

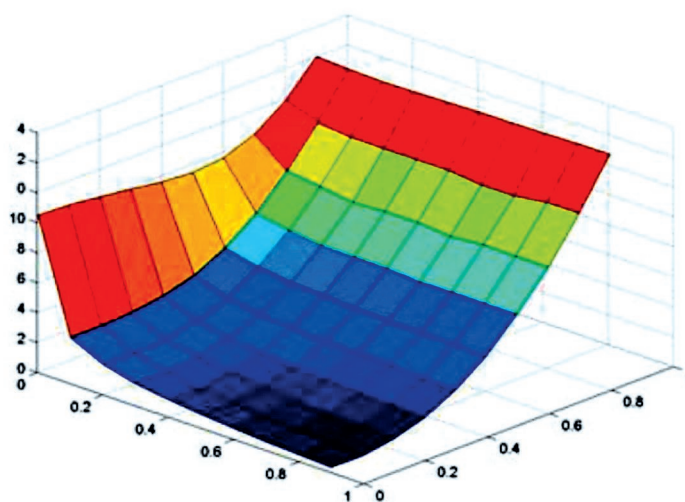


Figure 7. Quantity input (q).

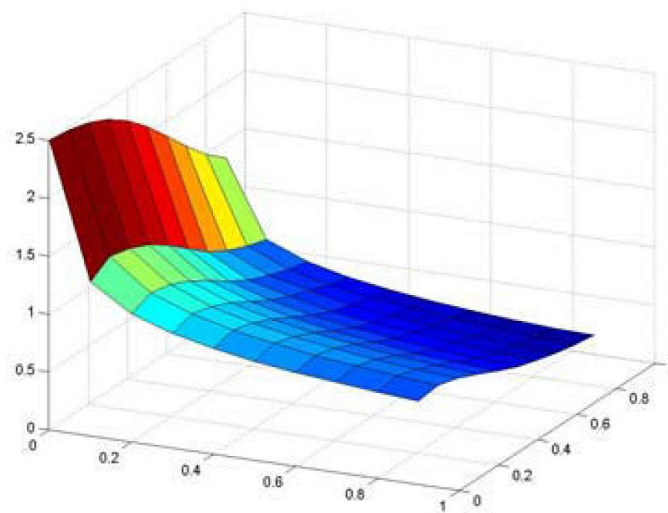


Figure 8. Expected input quality (s).

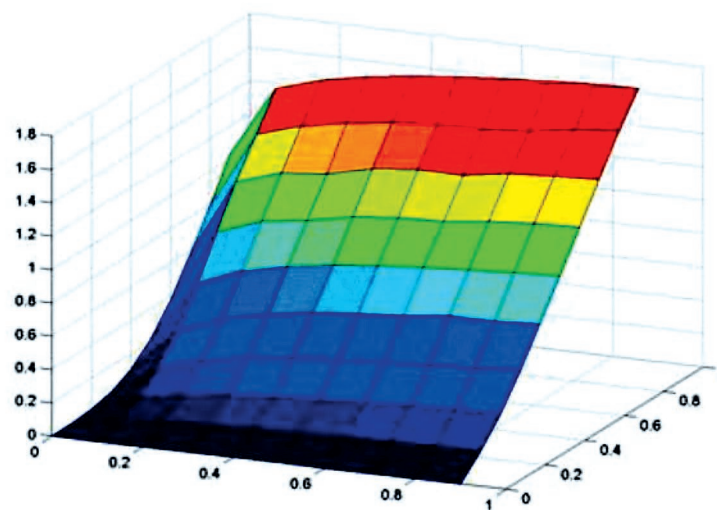


Figure 9. Processor's effort (b).

5. Discussion

Most previous studies in moral hazard ignore the fact that the agent makes both efforts in quantity and quality. The results presented in this paper shed some light on the importance and value of including in a moral hazard analysis model that in reality the agent expends effort in both quantity and quality.

The results of this analysis give some pointers as to why contracts different from share cropping contracts are often used for products where quality is a key competitive attribute and a distinguishing factor as it is currently the case in South Africa with the advent of large multinational and local agribusiness firms in the agricultural sector in partnership with land reform beneficiaries. It is common knowledge that in many highly differentiated products markets the consumers do not automatically know the quality of the product nor the accuracy of the information supplied about the characteristics of the products and this referred to as 'lemon problem' (Akerlof, 1970). The 'lemon problem' is the issue of information asymmetry between the

buyer and seller of an investment or product as popularized by a 1970 research paper by economist Goerge Akerlof. This observed asymmetric information between the processors and consumers has the potential to negatively impact the functioning of the product market (Akerlof, 1970).

The findings of this study should be viewed in the context of sub-Saharan Africa. Sub-Saharan Africa (SSA) has the lowest adult literacy rate. Huebler (2007) observed that SSA had an adult literacy rate of 63% in 2008. The relationship between a literate society and economic development is well documented (Jogwu, 2010). The ability of market participants to engage in effective and informed interaction in the market place is critical since, especially given that countries in SSA are transitioning from command economies to market-led development where illiterates interact with literates (African Progress Panel, 2015). The literate-illiterate interaction may engender information asymmetry in the contracting, that is, a situation where one of the parties to a contract, the literate party, has information that is not available to the other party, the illiterate party (Boadu, 2016).

The reality of the interactions at the market place gives rise to the two common problems associated with information asymmetry namely adverse selection and moral hazard. In adverse selection, the illiterate party may negotiate a contract that actually hurts their interests. For example, in a number of the cases studies in KwaZulu-Natal, South Africa, primary producers of fresh produce in partnership (joint ventures) with established agribusinesses tend to accept lower payment for their produce thinking they are getting a good deal believing that their produce is of inferior quality when in fact it meets the required quality standards. With moral hazard, the illiterate party lacks the ability to enforce terms of the contract. Contract that face these problems are also susceptible to the problem of the tragedy of commons. The tragedy of the commons is an economic theory of a situation within a shared-resource system where individual users are acting independently according to their own self-interest behave contrary to the common good of all users by depleting that resource through their collective action (Hardin, 1968). Such contracts cannot be value-maximising and often third party intervention is required to fill the gap thus levelling the playing field. The challenge is to define contract rules that do not destroy incentives on the part of the literate parties to interact with illiterate parties in the market place.

Moral hazard and adverse selection in big public-private sector partnerships and large scale land reform projects are skewing benefits in favour of the privileged elite who are more powerful due to their political connectedness, higher than average education and economic standing in society. The foregoing notwithstanding, there is a general consensus that there is a prominent role for large scale commercial agriculture and private sector (agribusinesses) to play in contributing towards the attainment of national and development goals in Africa. There is a school of thought that postulates that moral hazard can be prevented by a combination of incentives and constraints (Xion *et al.*, 2013). Monetary incentives such as profit, dividends and bonus payment for meeting and exceeding quality and quantity requirements are known to minimize the risk of moral hazard. Devolving more decision-making and handling of finances by the farmer as opposed to strict management by the processor were also found to incentivize the producer to be more involved thus negatively affecting moral hazard. Constraints factors that were found to have a negative bearing on moral hazard included production environmental supervision and supervision and enforcement of general good agricultural practice.

6. Conclusions

A number of useful conclusions can be drawn from the gleanings and nuances obtained from the results of this study. Of uppermost importance to investors in agribusiness, managers, policy makers and implementers of agricultural development programmes is an understanding of what makes partnerships work and what leads to premature termination of such partnership schemes in the South African agricultural sector environment. Moral hazard and adverse selection are major limitations for joint ventures in agribusiness in Africa, in general, and South Africa, in particular. There is general information asymmetry between the principal (agribusiness) and the agent (farmers/primary producers) which leads to an unequal relationship which generates mistrust

and suspicious between the partners. Furthermore, the recent history of South Africa, where land has been predominantly owned by one particular race group (whites) engenders mistrust now that substantial amount of land has been transferred to the black population group and the latter is being assisted by the government to make their land productive.

The conclusions point to several areas of intervention and investment opportunities for the public sector and agribusiness entrepreneurs, respectively. The provision of and investment in basic adult literacy, including and business management literacy and numeracy, for emerging commercial farmers is desirable. The study found that there is unequal yoking of agents and principals in agribusiness with the scales tilted in favour of the principal who are often educated, thus sophisticated, at the detriment of the agents (farmers) who are, in the main, illiterate or semi-literate. The investment in literacy improvement would enable the farmers to access and better synthesize available information to make better business decisions and better engage with the agribusiness partners.

The provision and availability of more market information such available markets, real time prevalent product prices, quality and applicable standards (such as phyto-sanitary, accreditation and traceability) to narrow the information gap between the farmers and agribusiness partners presents another opportunity for both investors and policy makers. Investment in information and communication technology such mobile phone apps and similar platforms to provide farmers with both marketing and agronomic information is one avenue that could be explored. South Africa has relatively good cell phone network coverage and most farmers have smart phones that could be used optimally to better inform the farmers thus empowering them to make informed choices.

It is generally accepted that public sector provided agricultural extension services have virtually collapsed in Africa leading to a paucity of technical information for farmers, especially emerging commercial farmers. The gap created by the insufficiency of government provided extension services presents an opportunity the private sector to provide technical production support to farmers and agribusiness sector. Input supply and commodity linked extension services and cost recovery from the farmers either directly or through cession on the proceeds from the sale of produce presents a viable option that has worked elsewhere in the world.

Joint ventures and other forms of partnership providing real equity and shares to farmers in the agribusiness are a viable option. Governments in Africa, and this is particularly true in South Africa, are willing to acquire shares in agribusinesses on behalf of the farming community through investing public pension funds and other related investments. This approach makes business sense in that it increases a sense ownership of the agribusiness by the farmers thus militating against moral hazard and incentivises performance and adherence to contractual obligations.

Some of the nuances from the study point towards the need for a neutral third-party mediator to solve contractual disputes and provide adjudication between contracting parties while providing an assurance of fairness and a favourable environment to re-negotiate terms when the need arises. This arbitration and mediation role naturally lends itself to be the domain of government and policy space. However, there is room for the private sector to support the capacity of the public sector through providing transaction advisory services and providing international best practice. Transaction advisory and mediation services are indispensable if joint ventures and similar business models are to successfully take-off and thrive in Africa. The existence of relative safety (protection and safe-guarding of interests) and stability for both contracting parties and the provision of a mutually-agreed arbitration process are necessary pre-conditions. Courts of law can provide enforcement of contractual obligations but this is often a tedious and expensive options thus the need for a more expedient and affordable option.

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