

**DOUBLE MORAL HAZARD AND RELATIONAL CONTRACT: EVIDENCE FROM  
GHANA AND EXPERIMENTAL ECONOMICS**

**COSMOS ADJEI**

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**School of Natural Resources and Environmental Sciences  
Newcastle University, Newcastle Upon Tyne, NE1 7RU  
United Kingdom**

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## **DECLARATION**

The contents of this thesis are my original research work and have not been presented elsewhere, either in part or as a whole, for any other award. I confirm that the word limit is within the prescribed limit as advised by my school. There is no collaborative or jointly owned work in this thesis, whether published or unpublished. Any form of support received for the study and all cited work have been duly acknowledged.

The following conference paper has been published from this thesis:

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## ABSTRACT

In developing countries, one of the main constraints for the development of value supply chains is side-selling and payment default by buyers. There is burgeoning literature examining financial and labour contracts in Sub-Saharan Africa, but less is known about informal contractual relations between buyers and sellers in agri-food markets. Yet, agribusiness development in Africa will depend on more stable contractual arrangements in food value chains. This study has two main aims: the first is to examine attributes of Ghanaian fresh vegetables supply chain contracts and second, to experimentally investigate the mitigation of double moral hazard in buyer-seller contracts. The first part of the study uses a survey method aiming to describe the nature of contracting and the factors determining contractual breaches by sellers. A logit regression results show that being an older farmer, distance to alternative market, monitoring and production management contract significantly increased side-selling while the time of contract price setting, time of payment, shorter contract relationship, and a farmer being a male positively influenced side-selling. The second study examines how an institution where buyers commit to a deposit of the value of payment agreed with the seller may resolve the contract breaches. This study aligns with the literature on informal and relational contracts, but rather than relying on repeated interactions and reputation it examines double moral hazard in a single shot game involving 294 participants. A buyer player proposes a contract price to a seller for the purchase of a commodity but can reduce the price ex-post. Similarly, the seller can side-sell the contracted commodity for a spot market price. The results show that fewer buyers voluntarily committed to a deposit of the payment but doing so resulted in a significantly less side-selling suggesting reciprocity in the seller's behaviour. Moreover, anticipating that buyers may not voluntarily commit to a deposit, an institution that enforces a commitment to the deposit was examined and shown to further decrease side-selling.

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## **ABBREVIATIONS AND ACRONYMS**

BENC	Behavioural and Experimental North East Cluster
BT	Baseline Treatment
ECU	Experimental Currency Unit
ET	Enforced Treatment
EU	European Union
EMC	Export Marketing Channel
GAP	Good Agricultural Practices
GAVEX	Ghana Vegetable Exporters
MOFA	Ministry of Food and Agriculture
OET	Optional Enforced Treatment
ONET	Optional Non-Enforced Treatment
OT	Optional Treatment
SSA	Sub-Saharan Africa
TMC	Traditional Marketing Channel
VEPEAG	Vegetable Producers and Exporters Association of Ghana



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# CHAPTER ONE

## Background of the Study

### 1.1 Introduction

This study examines the effect of contract terms on side-selling in the Ghanaian fresh vegetable value chain, and experimentally investigates double moral hazard in buyer-seller contracts. The study has two main parts: The first part uses a field survey to examine contract terms and how they drive side-selling in contracts while the second uses an experimental economic methodology to investigate the impact of a deposit-taking institution on side-selling in buyer-seller contracts. The study is divided into eleven chapters. This chapter sets the context of the study by discussing the drivers for coordination in the global agri-food value chain. The Ghanaian vegetable sector and its contribution to the economy are also discussed. Lastly, the research problems, objectives, and justification for the study are presented.

### 1.2 Context of the study

The last few decades have witnessed increased globalization of agri-food systems in developing countries, entailing interdependencies of world economies in food production, trade, and consumption. Several factors have contributed to the change, notably the promotion of international trade and technological advancement. For example, in examining the agri-food industry transformation and small farmers in developing countries, Reardon *et al.* (2009) observed that the changes in the agri-food system has been induced by multilateral trade liberalization, structural adjustment programs in developing countries, and improvement in logistics. Similarly, in his conceptual framework examining the responses to forces shaping agricultural marketing, Schrader (1986) showed that advances in biological and informational technologies form the basis for the increased industrialization of the agri-food sector in developed and developing economies. These assertions suggest that present and future reductions in trade barriers between countries as well as continued technological advances in transport, information, and communication technology would further transform global agri-food systems. While the direction of the transformation may not be accurately predicted, it will likely involve an increased volume of food trade, interdependencies among countries for food supply, and continually evolving

trade regulations. Drabenstott (1995), when exploring the agri-food transformation observed that the process of agri-food transformation and industrialization are driven by two critical forces, namely the consumer and the producer. The changing lifestyle of consumers resulting from increased wealth, shifting demographics and the growing consciousness of diet-related health conditions are influencing the food purchasing decisions of consumers. For example, Kherallah and Kirsten (2002) observed that preference for food quality, safety, consistency, and value affects consumers' food buying decisions in recent years. Moreover, there is an increasing concern about food safety and food scares particularly among fresh foods products such as fresh vegetables. These demands from consumers continue to drive food production and distribution in a way that preserves the quality and safety of the food. Emerging technologies in response to food safety and quality preservation in the food value chains have led to consolidation, specialized production, packing, and cold storage infrastructure for transport. For example, as was shown by Martinez and Poole (2004) in their examination of the private fresh produce safety standards, there has been a move by European retailers from the cross country differences in food safety regulations towards a harmonized private food safety standards. While Boehlje (1999) observed that existing and continually emerging technologies make it possible for the producer to deliver food with attributes that satisfy consumers' requirement investment in these infrastructures and specialized production technologies, however, require substantial capital which small farmers cannot afford. From the buying firm's perspective, these inputs constraints that militate against producers and the supply of the required quantity and quality of products that the market wants motivates contract farming. From the farmer's perspective, these transformations and market regulations happening downstream in the supply chain pose constraints in accessing market for their output if they cannot overcome them.

The contract farming literature argues that developing countries' smallholder producers often lack the requisite capacity to participate in emerging global agri-food markets in isolation due to the technologies, innovations, and regulations used by these consolidated retail outlets and chain actors for the procurement of food. These, therefore, raise concern for coordination and market linkages between agribusiness buying firms and farmers as a means of integrating smallholder farmers into the harmonized value chain. The reasons for

the focus on smallholder farmers, even though the firm's procurement systems favour larger farmers, include the following. First, according to the new institutional economics approach to agricultural policy and research in developing countries by Kherallah and Kirsten (2002), the emerging market presents a lucrative marketing channel to farmers and potential reward will be substantial if they could participate in it. Second, the significantly larger composition of smallholders in the world's food production suggests that their exclusion would imply a defeat against rural poverty alleviation and economic growth. For example, Fao (2014) and Ricciardi *et al.* (2018) examined innovations in family agriculture and how much of the world's food do smallholder farmers produce. According to them, a greater proportion (70-80%) of global food production involves smallholders, suggesting a potential systemic negative impact on livelihood, and food insecurity if they are excluded from a market that may soon become the standard, even in developing economies. A report on the world's smallholder farmers and food security by Ifad (2013) has shown that developing countries, particularly, Sub Sahara Africa (SSA) countries' agriculture is predominantly smallholder dependent, thus, making the need for integrating smallholders into the market imperative. While some firms have implemented with varying degrees of success, a backward integration that allows them to bypass smallholders in the agri-food supply chain, government policies restraining land grabbing by bigger and multinational agribusiness firms in developing countries suggest that smallholders would continue to dominate the agricultural production space. A market linkage between firms and smallholder farmers is, particularly, important in the high-value fresh vegetable value chain for their special attributes. First, according to a study by Little (2000), on contract farming and production relation in peri-urban areas of Sub-Sahara Africa, smallholders are efficient in the production of labor-intensive crops such as vegetables. While this observation may not be valid in the technologically advanced economies, it holds in many developing economies where the technology for planting and harvesting of vegetables is non-existent. To the extent that manual labour is used in the production of vegetables, smallholder farming, that rely on family labour is more efficient due to the labour intensity. To date, vegetable production is mostly done on small landholdings in many Sub-Saharan African countries. The second reason for a market linkage between buying firms and farmers is that the perishability of fresh vegetables allows for fewer storage options creating an imperative for quicker access to market and processing outlets immediately after harvest. The attributes of smallholders shown above, and the transaction characteristics of the

emerging value chain provides incentives for some form of coordination and strategic alliance between downstream buying firms and farmers.

Contract farming has emerged over the years as an effective transaction coordination governance mechanism that provides a linkage between smallholder farmers and markets. The definition of contract farming has been varyingly presented by the extant literature. For example, in examining contract farming and food security in Madagascar Bellemare and Novak (2017), noted that contract farming involves institutional governance under which an agribusiness buying firm contracts the production of agricultural products out to farmers. The arrangement usually involves a forwarding agreement and predetermined product prices. Navarra (2017) defines it as an arrangement by which a producer commits to supplying a product to a buyer. Similarly, the buyer must also commit to a price and other promises made to the producer in exchange for the product. An important feature of contract farming, as a transaction coordination governance, is that it addresses the uncertainties and cost associated with conducting transactions in the free market. Thus, due to the characteristics of transaction in the agri-food value chain explained in the introduction (smallholder farmers, input market failure, output market failure, uncertainties, and opportunism) the firm, for example, must search for farmers with the ability to produce quality products, and must monitor farmers to ensure production is undertaken under recommended agronomic conditions including the application of recommended inputs. Also, the firm must ensure that the farmers reliably deliver the quantity and quality of the product as agreed in the transaction. For the farmer, access to recommended production inputs and logistics is a challenge, and overcoming them comes with a cost. The potential information asymmetry between the buyer and the seller in a market exchange gives room for opportunistic behaviour by the farmer and leads to substantial transaction costs for the firm in mitigating the anticipated opportunism. Therefore, contract farming as a coordination mechanism emerges to resolve these uncertainties. The extent to which uncertainties could be addressed, however, will depend on the choice of contract terms, given the value chain transaction characteristics. Despite the benefits, however, contract farming has some constraints due to moral hazard. This thesis examines contract terms in the Ghanaian vegetable value chain and to what extent they mitigate or drive side-selling.

### **1.3 Overview of the Ghanaian vegetable sub-sector**

The vegetable sector is key to the Ghanaian economy. Recent dynamics within the sector suggest a potential for increased urban and peri-urban growth, employment generation, and significant contribution to the country's economic development. Locally, the emergence of supermarket chains, high-end restaurants, and hotels creates an immense opportunity for increased vegetable production to feed an ever-increasing middle class with the quest for healthy eating. On the international market, Ghana's geographic position favours the country comparatively, in developing a thriving export trade with destination countries in the European Union (EU).

The Ghanaian vegetable sector has arguably not received much public support in comparison with major staple crops. This is evident in the direction of Government policy. Government policies and interventions in the agricultural sector have focused much on boosting production and marketing in the tree crops and grains sub-sectors as manifested in the establishment of a commodity market for grains, and the proposed dedicated development authority for tree crops. Yet the vegetable sector contributes significantly to the nation's macroeconomic growth generating about 13.2% of agricultural GDP in 2015 according to a study of the state of Agriculture in Ghana by IFPRI (2018). A Ghanaian vegetable sector report by Gonzalez *et al.* (2014) shown that the vegetable sector contributed about US\$ 675 million to the total value of US\$ 6.4 billion realized from the overall crop and livestock production. Moreover, the sector is one of the major sources of employment in the rural economy of Ghana, providing a source of livelihood for most of the people working in the value chain. For example, a report by Boachie Danquah and Sulaiman (2015) on the Ghanaian tomato sector shown that tomato production created about 90,000 direct jobs for farmers, and more than 300, 000 jobs for individuals involved in the wholesale and retail of tomatoes. In terms of poverty alleviation, Clottey *et al.* (2009) in examining the tomato industry in the Northern region of Ghana shown that tomato production alone has created enormous worth for people even in the poorest parts of the country. In a related report by Trade Aid Integrated, an estimated 58, 640 individuals benefited economically from tomato production. There is an enormous contribution of the vegetable sector in terms of the nation's foreign exchange earnings and balance of trade. Statistics from the COMTRADE and documented by Gonzalez *et al.* (2016) shown that

Ghana generated, on average, a value of US \$15 million per annum from the export of vegetables to the European Union (EU) market before the sector was hit by an export ban in 2008. As the following discussions will show, however, a recent incident in the sector, both domestic and international, threatens the survival of the sector and, therefore, suggests the need for immediate interventions to curb what could potentially harm the possible gains by the sector.

As has been shown in the preceding discussions a major driver for increased vegetable production in Ghana has been the evolution of the export market and domestic supermarkets. However, domestic vegetable production for supermarkets and the export market has declined sharply, and what once was a lucrative business has lost its shine in recent years. Kwofi (2019), recently reported in a major Ghanaian news outlet that the dwindling fortunes of the vegetable sector have led to the loss of many jobs and potential earnings by the financially vulnerable smallholder farmers. He observed that many farmers have been forced out of contracts with vegetable exporters and had to take menial jobs in other sectors, namely construction, long haul transport, and similar trades for sustenance. Revenue generated by the sector from exports has reduced significantly from US\$ 4.35 million in 2011 to US\$ 669, 208 in 2018 according to data from Ghana Export Promotion Authority (GEPA). Figure 1.2 shows the yearly trend of the value generated from vegetable export over the last decade, revealing a substantial reduction in earnings over the last three years.

The declining earnings are partly a result of export bans on certain categories of vegetables from the EU market due to illegal levels of contamination present in imported vegetables in 2015. This followed a voluntary ban in 2012 by the Ghanaian Ministry of Food and Agriculture to rectify an earlier discovery of contamination in vegetable exports at exit points. In June 2019, Ghana renewed the voluntary ban for the same reasons despite a lift of the ban by the European Union in December 2017. These negative developments are indications that efforts by the Ministry of Food and Agriculture and other vegetable sector stakeholders to ensure farmers' and firms' compliance with food safety and quality regulation of the export market is not producing the needed results.

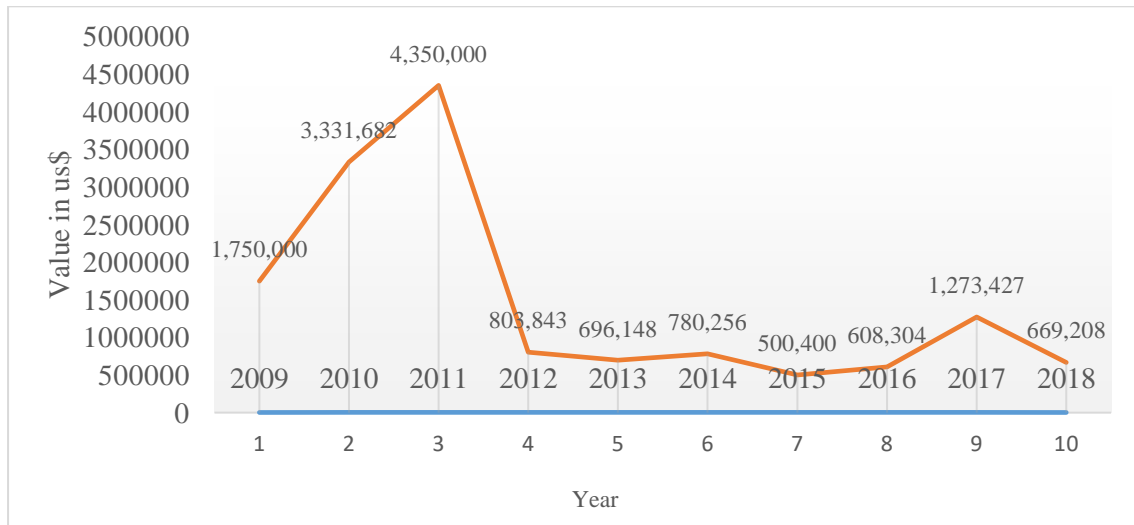


Figure 1. 1: Value of vegetable exports in US\$

Source: Ghana Export Promotion Authority, GEPA, (2019).

Apart from the loss of substantial foreign exchange from the inability to export, the nation is losing huge sums in foreign reserves annually for the importation of several metric tons of vegetables and vegetable products, particularly processed tomato. In 2006 Ghana was the second-largest importer of tomato paste in the world, importing about 25,000 metric tons at US\$ 25 million. A report from the Ghanaian Ministry of Food and Agriculture shown that Ghana imported UD\$112.1 million worth of tomato paste in 2013. The statistics have not changed over the last decade. For example, in examining the vegetable processing industry in Ghana, Boachie Danquah and Sulaiman (2015) reported that about 75,000 metric tons of tomato are imported annually.

#### 1.4 Vegetable production in Ghana

Vegetable production occurs in many rural areas and the outskirts of towns and cities throughout the country. According to the Ghanaian vegetable sector studies by Gonzalez *et al.* (2014), an estimated 78,000 hectares of land is put under vegetable cultivation annually. Major vegetables being produced include tomatoes, chilies (pepper), onion, eggplant (aubergines), and okra. They are considered major vegetables due to their high domestic consumption and widespread production, covering almost every geographic

region in the country. As shown by the FAO statistics in Figure 1.2, there is an increased production of these key vegetables.

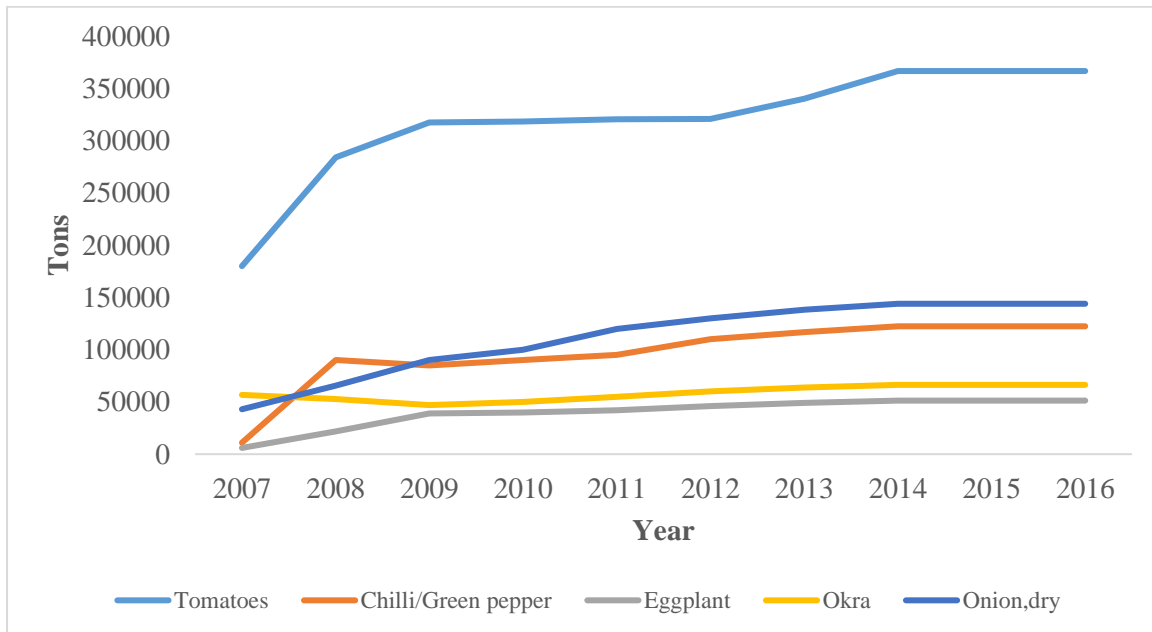


Figure 1. 2: Production of major vegetables in Ghana 2007-2016

Source: FAO stats (2016)

Vegetable production in Ghana is predominantly rain-fed and, as a result, leads to two production seasons in a year in the southern part of Ghana, following the rainfall availability. The major production season starts in March and ends by early July. This period is normally characterized by a good amount of rainfall and increased harvest, often resulting in low prices for fresh vegetables on the market. The minor season starts around mid to late August, following a short period of dryness between late July and early August, and ends by early November. The northern part of Ghana, however, has one production season spanning June to early November. The period starting early to mid-November and ending in February is characterized by dryness, meaning that only farmers with access to some form of irrigation can grow vegetables in this period. The period is characterized by less harvest and higher food prices. Recent years have seen growing irrigation farming especially along the Lake Volta, River Volta, and the Coastal areas of the country in response to the influx of supermarket chains and the growing export market. Vegetable production is done predominantly by smallholders, consisting of farmers with insufficient



knowledge in vegetable agronomy and the use of suitable production technology. Also, Gonzalez *et al.* (2014) found that these farmers have limited access to improved inputs and output markets.

### **1.5 Vegetable market in Ghana**

The marketing of Ghanaian vegetables takes place in four major market channels. These include the traditional market, the local supermarket, processing factories, and the export market channel. The traditional market, which consists of open markets and corner shops, dominates vegetable marketing in the country. In recent years there has been an influx of supermarkets in the country with a dedicated fresh vegetables retail section and, thus, offer a market avenue for vegetable farmers. The export market, dominated by large and small export firms, also constitutes a substantial market channel for Ghanaian fresh vegetable produce. The main retail market for these Ghanaian exporters is the ethnic market (mainly Asian consumers) in Europe, especially the UK. Unlike the traditional market, the export market, and the domestic supermarkets demand that actors in the value chain comply with food safety and quality regulations of the international market. However, enforcement of these regulations in the Ghanaian vegetable value chain has been a challenge. Vegetable processors are another important source of market for vegetable growers. Vegetable processing is, however, less developed in Ghana. Various actors, comprising itinerary traders, wholesalers, and retailers participate at various levels in the value chain from production through marketing to the final consumer. A detailed description of the vegetable marketing system in Ghana is provided in section 2.1.

### **1.6 Contracting in the Ghanaian vegetable sector**

Contract farming as important vertical coordination is being promoted by many development agencies and used in the value chains of many sub-sectors of the agricultural sector. Among the sectors with considerable engagement in a contract is the horticultural sector, particularly for pineapple and fresh vegetables. The vegetable sector has a long history of contract farming involving agribusiness firms and smallholder farmers but unlike in pineapple production, the literature on vegetable contracts is limited. Contract farming has been the main vehicle for procuring raw materials for domestic agro-processing since

the establishment of the first three food processing factories in the post-independence era, and in recent years for the production and procurement of vegetables by exporting firms following the evolution of the export trade. The volume and the range of commodities procured through contracts continue to increase over the years especially in the export market channel. Gatune *et al.* (2013) for example, observed that an estimated 50% of exported pineapple in the peak production years are procured through contract farming involving several smallholder farmers. Three factors have contributed to the increased use of contract farming in the vegetable value chain. The first, as has been indicated earlier, is the evolution of horticultural export because of the rising international demand for vegetables. The stringent requirement for food safety and quality in the export trade has necessitated the use of contract as a form of transaction coordination in the food production and distribution process. The second involves the emergence of processing firms in response to the rising urban demand for processed food as well as the need to increase the shelf-life of fresh fruits and vegetables. Lastly, ownership of Ghanaian agricultural lands resides with individual families, mostly smallholders, in fragmented portions. It is difficult for a firm, therefore, to access a large parcel of farmland without having to enter a contract with farmers. The formation of contracts is based on an agreement between the firm and farmers. Fafchamps (2003) and Freeman *et al.* (2008) in examining market institutions in Africa and the potential of contract farming in Ghana, respectively observed that in the West African Agricultural markets, contractual agreements are usually based on trust. These trust-based arrangements are described as informal verbal contracts and their predominant usage is believed to originate from a lack of efficient formal institutions for formal contract enforcement. Informal contracts will be discussed later in the study.

## **1.7 Problem statement**

In Ghana and developing countries in general, one of the major constraints of contractual agreements and militates against the development of successful agribusinesses and efficient performance of the micro economy is moral hazard. One of the pervasive forms of moral hazard in the agricultural value chain is side selling. Side-selling also, known as extra-contractual marketing, refers to a phenomenon where a farmer who has been contracted to produce and deliver a commodity for use by an agribusiness firm decides to cheat, by selling the commodity outside the contract, usually to another buyer. Figure 1.3 shows the

concept of side-selling in the Ghanaian food chain. The left side of the diagram shows buying firms that have a contractual agreement with farmers.

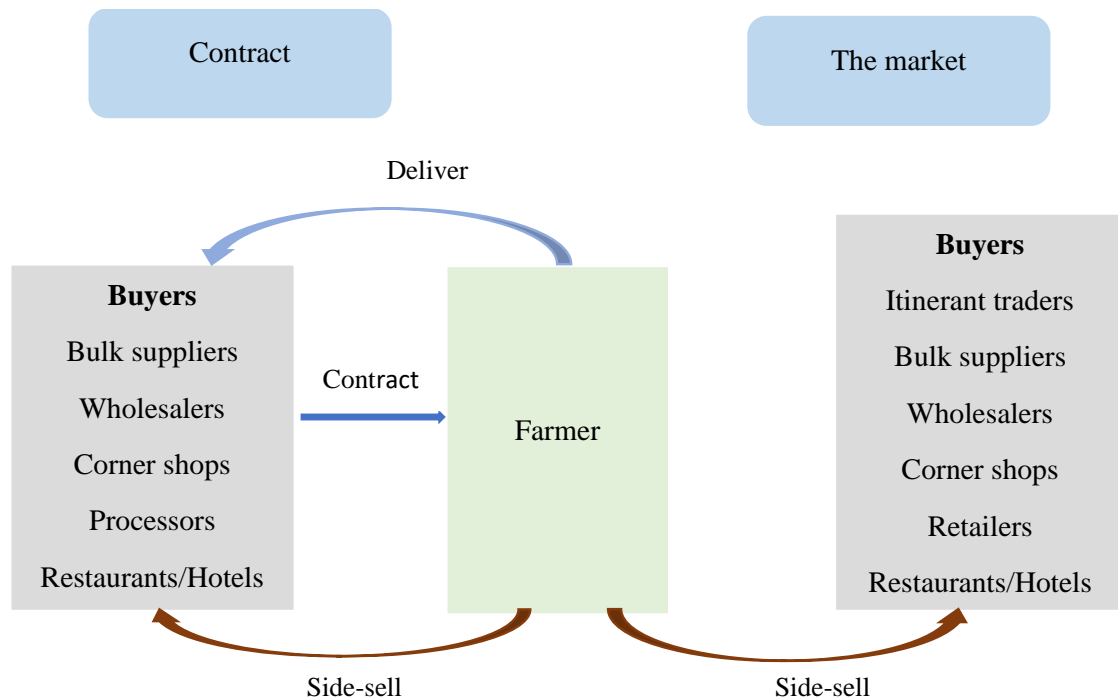


Figure 1. 3: The concept of side-selling in the Ghanaian food chain

The buyers include mainly Bulk suppliers, processors, wholesalers, corner shops, and in few instances include restaurants and hotels. These buyers and their functionalities in the vegetable value chain are described in detail in the next chapter. The down arrow moving from the farmer to the buyers on the left of the diagram describes a phenomenon of side-selling involving contract buyers. The buyers, though have contracts with other farmers, may purchase products from other contract farmers to supplement their requirements. On the right side of the diagram are buyers who do not engage in a contract but buy products from the spot market, and contract farmers through side-selling.

Side-selling occurs in almost every agricultural commodity value chain in Ghana that engages in a contract. These include, for example, the grains, tree crops, fruits, and vegetable value chains. In the grain value chain in Ghana, Ragasa *et al.* (2018) observed

that, though contract farmers were required to sell output under the contract, they rarely did. Similarly, Manley and Van Leynseele (2019) observed side-selling in the oil palm value chain, one of the major agricultural sub-sectors that commonly engage in contract farming in Ghana. Pineapple production is one of the promising horticultural sectors in Ghana, creating business for many actors including domestic processors, and as an important non-traditional export. A survey of the Ghanaian horticultural sector by Barrett *et al.* (2012) and Wuepper and Sauer (2016) shown a prevalence of side-selling among farmers.

Recent events have shown that side-selling is pervasive in the vegetable value chain. Adu-Gyamfi (2008), in examining the Ghanaian vegetable sector and the impact of private standards on African vegetable growers indicated that the majority of contract farmers hired under the Wenchi Tomato Processing Project (WTPP) by Afrique Link Limited reneged on their contract and sold tomatoes through the local spot market when spot market price rose above the fixed contract price. Under the same scheme, Boachie Danquah and Sulaiman (2015), observed that farmers proximal to the Ivorian border smuggled tomatoes to the neighbouring country. Robinson and Kolavalli (2010) confirmed the widespread side-selling in the vegetable value chain by showing that contract farmers breached their agreement with the Pwalugu Tomato Processing Factory in the northern part of Ghana, by selling contracted tomatoes outside the contract. He noted that farmers readily accepted a contract from the company even at a low contract price, intending to take advantage of company supplied inputs and later turn to the local market for a higher spot market price.

The implication of side-selling in the Ghanaian vegetable value chain has been enormous. A major effect of side-selling in recent times relates to the ban placed on vegetable exports from Ghana. The effect is described as indirect in the sense that side-selling does not directly result in an export ban. However, industry experts and institutions in the value chain such as the Vegetable Producers and Exporters Association of Ghana (VEPEAG) and Ghana Association of Vegetable Exporters (GAVEX) have attributed poor vegetable production practices which resulted in export bans to side-selling and the resultant breakdown of coordination between farmers and exporters. They assert that the fear of

hold-up through side-selling offers disincentives for buying firms to commit to asset-specific investments such as recommended production inputs, investment in vegetable production infrastructure, and building of farmers' technical knowledge in vegetable agronomy which is necessary for the delivery of safe and quality vegetables. Thus, lack of investment in production and input support services for farmers, and the preference of many buyers to engage in spot trading rather than contracting, due to previous years of hold-up from side-selling have resulted in poor and unsupervised production practices by farmers. In a comparative study of contract farming in five developing countries including Ghana, Barrett *et al.* (2012) observed that prospective hold-up indeed created disincentives for firms to have contracts with farmers. As has been shown earlier, smallholder farmers may not be able to meet the rigorous regulatory requirements of the high-value market without some form of coordination with financially able buying firms.

Apart from the challenges facing the export sector, domestic agro-industrial projects are confronted with the threat of failure due to capacity problems arising from side-selling. The Wenchi Tomato Processing factory established under the Government of Ghana's special initiative on agro-industrialization in the early 2000s folded up not long after it started operating mainly due to side-selling. Other individual buyers have lost their businesses with either an importer or a domestic retailer for inconsistencies and failure to meet supply agreement due to side-selling. The Government of Ghana launched a policy initiative aimed at boosting industrialization in what is termed 'One District One Factory' (1D1F) in 2017. The policy aims at establishing a processing factory in each administrative district of Ghana based on the district's raw material resource endowment. One of the major challenges dominating discussions in the media as a potential threat to the sustainability of agro-based 1D1F has been contractual breaches through side-selling. These developments in the processing, domestic, and the export marketing channels suggest the need for immediate interventions to curb what could potentially harm the possible gains by the sector.

In Ghana, the lack of robust institutions to enforce contracts and cultural contexts lead to informal verbal contractual arrangements, which are non-enforceable. In the absence of efficient institutions and processes to formally enforce a contract, trust becomes the basis

for exchange (Fafchamps, 2003; Wuepper and Sauer, 2016). However, the declining trust between agribusiness firms and farmers observed by Wuepper and Sauer (2016) and Fischer and Wollni (2018) in developing countries means informal verbal contracts remain vulnerable to breaches.

Despite the potential threat posed by side-selling to the effort towards addressing market failure through farmer-firm coordination and agro-industrial development, limited studies have explored the causes and possible mitigation measures. In Ghana, limited study has been conducted, to the best of knowledge, despite side-selling being a major concern among value chain actors and its obvious harm to the value chain. Attempts have been made in recent literature to address contract breaches by examining farmers' preferences for contract design attributes and market characteristics (Abebe *et al.*, 2013; Vassalos *et al.*, 2013; Barrowclough *et al.*, 2015). These studies posit that a contract design that considers farmers' preferences in the determination of contract attributes can create a stable buyer-farmer relationship. For example, Abebe *et al.* (2013) argued that contract terms are often biased towards buying firms, thereby offering disincentives for farmers to comply with them. Their study suggests that given farmers significant decision power in the determination of contract terms offers disincentives for breaches.

What has not been adequately addressed by the extant contract farming literature is whether the choice of contract terms is efficient in addressing coordination problems such as side-selling. From the theoretical literature, a contract is a transaction coordination governance mechanism that aims to address uncertainties and opportunism in a market transaction. However, the extent of coordination that contract offers, and mitigation of opportunism will partly depend on the definition of the contract terms, especially in the absence of formal enforcement. Thus, the appropriateness of the contract terms in addressing the uncertainties that give room for opportunistic behaviours, other than one's preference for a contract term is crucial to resolving moral hazard in contracts. The empirical literature has also shown that contracting parties may choose contract terms for reasons and motives other than addressing opportunism. For example, in the case of buying a firm, Barrett *et al.* (2012) noted that a major reason for the preference for a verbal contract is the flexibility it offers

firms to renege when market condition favours the act. Similarly, a farmer may strategically, prefer biased contract terms that allow the flexibility to breach contract without suffering any significant penalty. Another factor that can influence the choice of contract terms involves the skills of the parties. Without the requisite technical skills to determine appropriate contract construct that provides incentives for compliance, contract choices may be vulnerable to breaches. This section of the study investigates contract terms in the Ghanaian vegetable value chain and to what extent they drive (or mitigate) side-selling.

### **1.8 Objectives of the study**

Contracting in food chains is a relevant and topical issue. In developing countries, including West Africa, contract breach has become a normal practice that undermines the modernization of food chains and leads to significant macro and microeconomic losses. As pointed out above, it is not clear what contract terms are most common in the fresh vegetable value chain in Ghana. Thus, the first goal of this thesis is to examine the terms of contracts in the Ghanaian vegetable value chain. More specifically the following research questions will be addressed:

1. What contract terms are mainly used in vegetable supply chain contracts?
2. What (if any) are the contract terms driving side-selling?
3. What are farmers' views on side-selling?

Then, recognizing that contract breach is a problem of hidden action or moral hazard in buyer-seller relations, the second aim of this investigation is to:

4. Examine the extent of double moral hazard in buyer-seller contracts.
5. Assess the relative impact of mandatory and voluntary enforcement of buyers' contract offers on sellers' contract breach and aggregate profit.

### **1.9 Thesis structure**

The thesis is organized into eleven chapters. The background chapter laid out the research issues and the rationale for the study. Chapter two describes the Ghanaian vegetable marketing systems while chapter three reviews the literature on vertical coordination.

Chapter four presents the conceptual framework for analysing contract terms and their effect on side-selling in the Ghanaian vegetable supply chain. In chapter five, the results of the survey on contract terms and their effect on side-selling are presented. Following on the survey results, the remaining chapters employ a more robust analysis to investigate double moral hazard and strategies for their mitigation in non-legally binding buyer-seller contracts. Thus, chapter six presents a literature review on contract theory and institutional economics. A buyer-seller model with moral hazard is presented in chapter seven whereas chapter eight presents the experimental methods for the study. In chapter nine, the experimental results on the investigation of double moral hazard are presented, and then the discussion of the results presented in chapter ten. Finally, the conclusion of the study, limitations, and recommendations for future study are presented in chapter eleven.



## **CHAPTER TWO**

### **Description of the Ghanaian Vegetable Marketing System**

#### **2.0 Introduction**

The previous chapter sets the context of the study by establishing the essence of contract farming and the factors that drive it. A brief overview of vegetable production, marketing channels, and contracting in the value chain was presented. The chapter concluded by presenting the problem statement, detailing one of the major constraints to successful contract farming. This chapter presents a description of the vegetable marketing system in Ghana. Section 2.1 describes the nature of the vegetable marketing system, starting from the upstream producer down to the final consumer. It describes the various actors, intermediaries, and their functionalities. Section 2.2 describes the regulatory institutions in the supply chain. Section 2.3 describes the pricing mechanisms in the supply chain while section 2.4 concludes by presenting the constraints in the supply chain.

#### **2.1 The nature of vegetable marketing systems in Ghana**

This section describes the network of sellers, buyers, and actors who engage in the fresh vegetable trade in Ghana. Also, providers of supporting services such as production inputs, infrastructure, and institutions for food safety regulations are described. Perishability, seasonality of production, and bulkiness of products make fresh vegetable marketing a complex and risky enterprise. These unique characteristics have generated a distinct vegetable marketing system. The spectrum of vegetables value addition and distribution, from the farm gate down to the final consumer, involves variant value chain channel innovations. To provide detailed insight into the various channels, their organization, functionality, and relationships, it is important to first understand in detail the existing major markets for Ghanaian fresh vegetables.

First, the Ghanaian vegetable market is broadly divided into the domestic and the international market. The domestic market constitutes the largest in terms of market share and is segmented into supermarkets, traditional (local) markets, corner shops, and vegetable processors. The European Union market is the main export destination for Ghanaian

vegetables. These marketing channel divisions are based on the product’s retail market. In the following, each of these marketing channels, shown in Figure 2.1 is discussed.

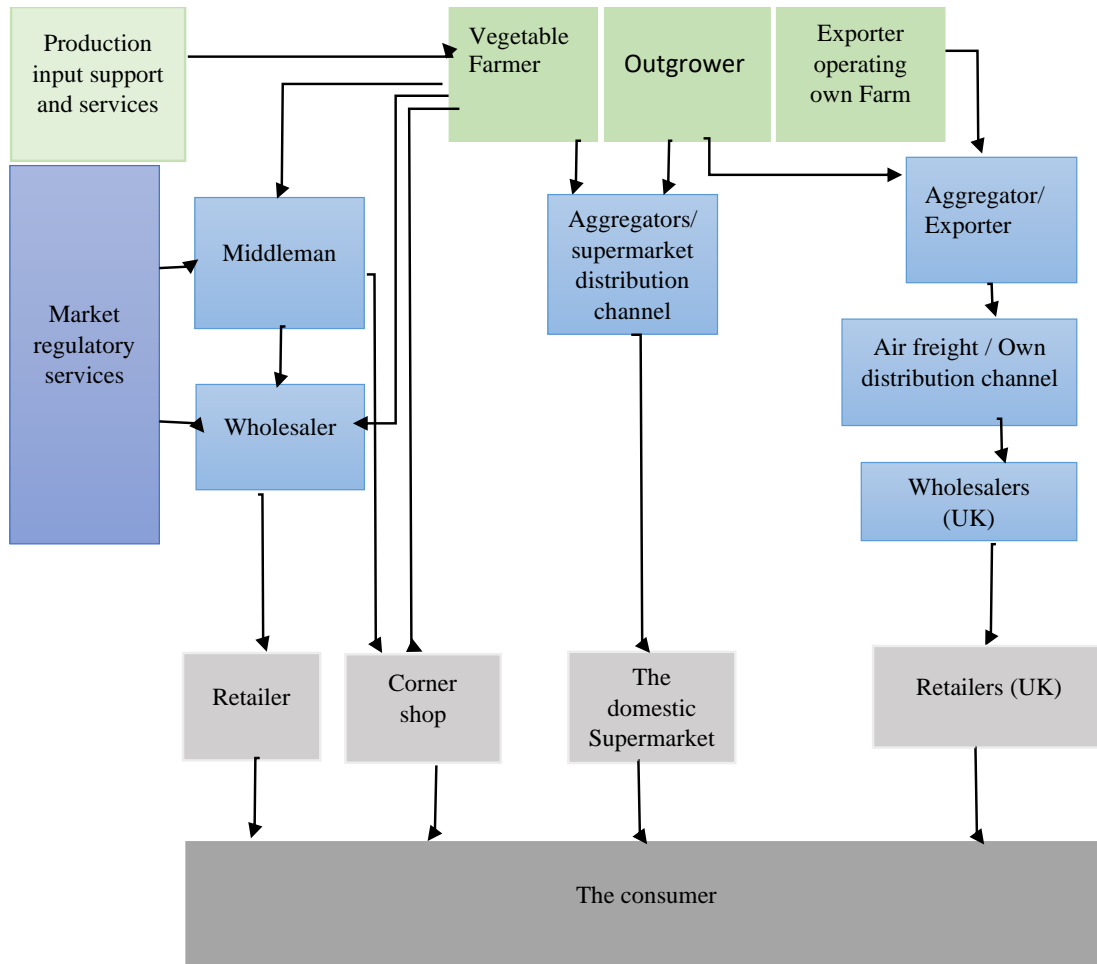


Figure 2.1: The Ghanaian vegetable supply chain

### 2.1.1 The traditional marketing channel

The traditional Ghanaian marketing channel is one that comprises central markets serving as points of buying and selling various commodities including vegetables. These markets are located either in an open space or under sheds, and products are sold on table stands, elected platforms, or on similar structures. Women traders are the largest group of traders in this type of market. The market is largely managed by women traders known as ‘Market Queens’. The description and the role of ‘Market Queens’ who are considered as important actors in the value chain are shown in a later section. Further, a notable characteristic of this market is its lack of adequate infrastructure for cold storage and preservation of

vegetables, resulting in a quick deterioration of vegetables and a reduction of fresh vegetables' shelf life. It is common to find vegetables sold on the bare floor or sheets of plastic, spread on the floor in the open space. The marketing channel is generally less integrated with minimal involvement of buying firms in the activities of the producers upstream. Thus, there is a general minimal product quality concern in the traditional market channel.

Vegetable trade in the traditional market constitutes about 70% of the total Ghanaian fresh vegetable market (Gonzalez *et al.*, 2014). Though what drives higher farmer participation in the traditional marketing channel is not clearly understood, Lee *et al.* (2012) in examining global value chains and agri-food standards noted that smallholders prefer the traditional marketing channel due to the minimum entry barriers, as well as fewer safety and quality requirements. Transactions are mainly face-to-face and take place either at the farm gate or at the central market. Also, transactions are usually based on immediate cash payments to farmers. These buyers, particularly the itinerant traders, are usually intermediaries between the farmers, and the wholesalers stationed at the central market. Direct transactions between a farmer and wholesalers or retailers also occur, usually at the central market.

As shown on the left side of Figure 2.1, the traditional marketing channel is relatively complex, consisting of different channels types for the movement of vegetables from the farmer to the final consumer. In the first channel type, involving three intermediaries, vegetables move from the farmer to the wholesaler through the middlemen (itinerant traders). The wholesaler then sells to retailers who in turn retail to final consumers. This channel can be described as the conventional and the most common observed in the traditional Ghanaian vegetable value chain. The next channels are variations of the standard channel. Thus, the second channel has two intermediaries and involves direct sales of vegetables from the farmer to the wholesaler without passing through the itinerant traders. The third channel also has two intermediaries, the itinerant trader, and the corner shop (retailer) but excludes the wholesaler. This channel type is common with corner shop operators, who are described in section 2.1.2. The last channel type of the traditional

marketing channel has a single intermediary and involves direct sales from farmers to corner shops. To further provide insight into the operations of the traditional marketing channel, the next sections describe the actors at the various stages of the channel and their respective functions.

#### **2.1.1.1 The traditional market value chain actors**

The traditional market value chain actors consist of farmers, buying firms as either itinerant traders or bulk suppliers, wholesalers, and retailers. The bulk suppliers and the itinerant traders are intermediaries (middlemen). Smallholder farmers dominate the vegetable production sector in Ghana. The definition of what is smallholder is not consensual in the literature. One definition uses the amount of land to classify farmers. The Ghanaian Ministry of Food and Agriculture, MOFA (2013) defines a smallholder farmer as one farming less than 2 hectares. On the other hand, Ekboir *et al.* (2002) indicated that a smallholder farmer in Ghana has a land size of fewer than 5 hectares. The problem with defining a smallholder based on land size is that resources and labour intensity involved in production differ across crops and to a large extent determines land size. For example, the minimum surface of a viable maize farm maybe 2 hectares but may only take a quarter of a hectare to have a viable tomato operation. This has been well captured by Von Braun (2005) who argues that a farmer producing a staple crop for home consumption and another producing a high-value crop for the market cannot be compared based on land sizes. Asuming-Brempong *et al.* (2004) in describing a Ghanaian smallholder, argues that landholding is not the best way to define smallholders. They posit that the availability of a range of resources and risk conditions should be considered in the classification. Chamberlin (2007) opined that a smallholder maybe one with limited capital, fragmented landholdings, and limited access to inputs. While it is difficult to estimate land sizes of vegetable farmers, the definition of smallholder adopted in this study follows Gonzalez *et al.* (2014) who noted farmers in the vegetable sector have insufficient knowledge in vegetable agronomy and the use of suitable technology. Also, their access to improved inputs and output markets is limited. They operate fragmented farms and primarily service the domestic spot market. Occasionally, they engage in contracts as independent growers or as part of an out-grower scheme of processors and exporters. Farmers supply vegetables mainly to the two types of traders (bulk suppliers, itinerant) traders) who in turn supply wholesalers in major local market centers or directly to the wholesaler.

Important actors in the traditional marketing channel are the middlemen. The concept of a middleman (intermediary) is used in the marketing literature to describe a supply chain actor who functions as a link between producers and consumers. Therefore, in the vegetable chain, domestic bulk suppliers and itinerant traders are considered middlemen, whose activities involve traveling to the hinterlands of central markets of cities and towns to trade directly with farmers. Domestic bulk suppliers, according to (Gonzalez *et al.*, 2016) supply about 80 percent of the vegetables sold in the traditional market centers, usually through a supply contract with wholesalers. They supply large volumes and on regular basis. Itinerant traders have a similar function as the domestic bulk suppliers, but their volumes are smaller and usually do not have a supply contract with wholesalers. They supply about 15% of the product sold at the traditional market. Since vegetable production is predominantly smallholder based, a major function performed by middlemen is product aggregation. They usually must collect vegetables from several farmers at different locations to fulfill a consignment, which is usually a truckload. Another role of the middlemen includes value addition (processing), entailing sorting and packaging at the farm gate, and subsequent transport of product to the marketing centers, thereby enhancing the product's place utility.

Another important actor in the traditional marketing channel is the wholesaler. Wholesalers describe a category of buyers, usually individuals, who buy larger quantities of vegetables from itinerant traders, domestic bulk suppliers, *or* directly from farmers, and resell to retailers. Unlike itinerant traders and domestic bulk suppliers, wholesalers have storehouses in the central market for the storage of vegetables. Lack of cold storage for these traders, however, is a major constraint for vegetable quality and shelf life, which usually manifest in half spoiled vegetables being sold on the market, and tons of rotten vegetables thrown away. Lack of cold storage affects the quantities of vegetables that wholesalers can purchase from their suppliers at a time. As a remedial strategy, they have a procurement model with suppliers and retailers which ensures that they maintain just enough stock to avoid spoilage but meets retailers' needs. For example, the trading network, led by Market Queens, provides specific weekdays days on which traders can deliver supplies to the market to avoid excess deliveries on the market. This mechanism, however, serves another purpose for 'Market Queens'; to control price as will be shown in later discussions.

‘Market Queens’ are women leaders who are regarded as important actors in the traditional Ghanaian vegetable value chain. They play two roles in the market. Apart from being traders themselves, usually wholesalers, they provide leadership and serve as regulatory institutions in the market. In the traditional market, traders are organized into groups according to the type of commodity they trade. The function of a Market Queen, therefore, is to manage this organization of commodity-specific traders and, derive their names from the type of commodity traders they manage. For example, a market queen managing group of pepper traders is referred to as ‘Pepper Queen’, which is ‘*Mako Hema*’ in the local *Akan* language. The general perception of ‘Market Women’ in the Ghanaian public space, among upstream actors and consumers in the supply chain is that of a ‘cartel’ and ‘mafia’ institution that impede the functioning of the market mechanism. They are seen to leverage their power to set lower produce prices for producers in the upstream node of the chain and strategically influences higher prices at the retail node. They are seen to create artificial shortages in the market that allows them to control price. They are regarded as an autocratic institution that imposes market-related decisions on traders and raises market entry barriers for new traders. These perceptions reflect a cross-section of the Ghanaian public including especially farmers and consumers. In an analysis of the role of the institution by Scheiterle and Birner (2018), however, ‘Market Queens’ were observed to provide informal safety nets for traders and information on commodity prices and quantities in other towns. Thus, contrary to the negative perception, Lilli Scheiterle and Regina Birner, argue that ‘Market Queens’ are important institutions in the marketing channel and that the negative perception about them is a result of narrow understanding by the public of their role.

### **2.1.2 Corner shops**

Corner shops are retailers who operate under erected sheds and in shops on major and auxiliary streets in towns and cities, and procure vegetables from either itinerant traders and domestic bulk suppliers or directly from farmers, without using the wholesaler, as shown also on the left side of the value chain map in Figure 2.1. This section of the market, though is not given a distinct recognition from the traditional market, operates in a comparatively hygienic environment, and is perceived by consumers to sell superior quality

vegetables than their counterparts in the central traditional market. Corner shops are growing at a speed, with operational characteristics akin to the fresh fruit sections of modern supermarkets. Due to their adherence to basic food quality and safety measures coupled with their accessibility, corner shops are increasingly emerging as an alternative joint for vegetable purchases by the elite, who hitherto prefer to shop at supermarkets.

### **2.1.3 The supermarket channel**

The emergence of supermarket chains in Ghana with dedicated fresh vegetable sections started in the early 2000s. Even though few supermarket chains have existed earlier, the last two decades marked the advent of the influx of multinational retail giants such as Shoprite and Marina supermarkets among others that sell fresh vegetables. The growth of supermarkets in Ghana is associated with a broad national economic growth and the nation's increased attraction for investments in recent times. According to Anku and Ahorbo (2017), the increased inflow of foreign direct investment (FDI) to the country in the early 2000s spurred the development of modern retail infrastructures such as the Accra Mall, Marina Mall, West Hill Mall, Legon Mall, and many more, which contributed to the growth in supermarkets chains. Though the number of supermarkets with fresh vegetable sales are still few with less than 1% domestic market share, Gonzalez *et al.* (2016), in investigating vegetable sector opportunities in Ghana observed that supermarkets' vegetable market share continues to increase. Supermarkets are now considered one of the marketing channels offering an alternative market for vegetable growers in the country. Unlike the traditional marketing channel, however, supermarkets have strict food safety, quality, and procurement requirements akin to the export marketing channel that must be adhered to by chain actors.

The Ghanaian supermarket value chain is relatively simple in terms of the number of intermediaries involved as shown in the middle section of the value chain diagram in Figure 2.1. Like the traditional marketing channel, farmers in the supermarket channel are mostly smallholders but demonstrate compliance to Good Agricultural Practices (GAP) or are Ghana Green Label certified. Intermediaries, ranging from itinerant traders, domestic bulk

suppliers to mostly medium size agribusiness firms serve as aggregators collecting vegetables from individual farmers for sale to supermarkets. Because of the requirement for GAP in this channel, the intermediaries' procurement model involves a contract with dedicated farmers, provision of training for farmers in good agricultural practices, and helping farmers acquire Green Label Certification. The second category of farmers in this channel includes large firms with their delivery systems for direct delivery of high-quality fresh vegetables to supermarkets. Firms in this category mostly have an infrastructure for irrigated farming, cold storage, and transport. Their adherence to GAP and subscription to Green Label Certification facilitates their service to other high-end markets such as popular hotels and restaurants.

Some supermarkets operate their farms through an out-grower scheme, with vegetables going through their distribution channels. This model became necessary in the value chain when supermarkets realized they could not source adequate high-quality and safe vegetables domestically. Other sources of vegetables to supermarkets are through imports from overseas farms. As has been indicated earlier, supermarkets have difficulty accessing consistently high-quality vegetables from the domestic market and, therefore, must rely on imports to meet demand. For example, Gonzalez *et al.* (2014) observed that Shoprite, a foreign-owned supermarket in Ghana, imported tomato and lettuce from the Netherlands. A recent development in the vegetable sector comprising periodic training in good vegetable agronomic practices for sector players championed by the Government of the Netherlands is expected to change the narrative. Similarly, the development of the Green Label Certification and the incentives offered to farmers to be Green Label compliant is expected to increase the production and supply of high-quality and safe vegetables to supermarkets.

#### **2.1.3.1 Actors in the supermarket channel**

As has been explained earlier, farmers in the supermarket channel comprise smallholders and medium to large companies. While smallholder farmers must be linked to supermarkets by an intermediary, large companies have a delivery system that allows them to deliver directly to supermarkets. A typical example of a larger company that grows and supplies



safe and quality vegetables to supermarkets is Eden Tree. Before emerging as a large-scale producer and supplier of vegetables, Eden Tree functioned as an aggregator, collecting vegetables from several smallholder farmers for sale to supermarkets.

Supermarkets' itinerant traders comprise few local intermediaries that procure vegetables from smallholders. They usually have contracts with supermarkets and sell according to specifications, pre-agreed price, delivery schedules, food safety, and quality control procedures. These suppliers are responsible for just about 1% of vegetable trade in the entire vegetable value chain. Importers are a group of supermarket chain actors who source vegetables from outside Ghana and supply to supermarkets. They are responsible for about 2% of fresh vegetable trade in Ghana. An example of these traders is Freshmark, which is a Shoprite supermarket's fruit and vegetable procurement division.

#### **2.1.4 The export marketing channel**

The export market constitutes a substantial marketing opportunity for Ghanaian fresh vegetable producers. Unlike the traditional Ghanaian market, however, participation in the export market channel requires actors to comply with stringent food safety and quality regulations. The value chain, from the upstream node, which begins with the Ghanaian farmer and ends with the European consumer, involves diverse channels with different stages and actors as depicted in the far right of Figure 2.1.

##### **2.1.4.1 Actors in the export marketing channel**

There are three categories of farmers in the export marketing channel; smallholders, out-growers, and exporting firms who operate their farm. The first channel describes a typical and long-existing export market value chain in Ghana. It involves small and medium-size exporters acting as intermediaries between smallholder vegetable farmers and the vegetable wholesale markets in Europe, particularly in the UK. Hence their activities include procuring vegetables from aggregators who collect produce on their behalf or directly from smallholder farmers through some form of a contractual arrangement. The other channels comprise large exporters who operate their farms and secure some vegetables from farmers under an out-grower scheme.

Ghana has over the years, remained one of the largest exporters of vegetables to the EU market, and the largest (non-EU country) exporter of chilli (pepper) to the UK. The main destination country for exported Ghanaian vegetables is the United Kingdom. There are four major wholesale markets in the UK for Ghanaian vegetables namely, the Western International Market, New Spitalfield Market, New Covent Market in London, and West Midlands in Birmingham. These products are mostly retailed in the ethnic market in the UK (mainly Asian consumers). Major vegetable export from Ghana includes chilli (pepper), okra, eggplant, bitter gourd, ravaya, tinda, marrow, baby corn, and butter squash, with chilli being the highest exported vegetable.

### **2.1.5 The vegetable processing industry in Ghana**

The vegetable processing channel involves mostly smallholder farmers, as producers of raw materials either through an out-grower scheme or through a contract farming arrangement with the processor. Generally, in Ghana, vegetables are consumed in their raw state, cooked, or have minimal processing, hence the processing industry constitutes a smaller percentage of the vegetable value chain.

### **2.1.6 Other actors in the value chain**

Other important actors in the vegetable supply chain are inputs dealers, transport operators, and financial service providers. Vegetable production involves many factors relating to the input market, and one of such is the availability of quality seeds and agrochemicals. Unlike in other jurisdictions, seed production in Ghana does not involve corporate bodies or multinational companies but is confined to progressive farmers who are registered seed growers, seed dealers, and some NGOs. These groups are responsible for the production and marketing of seeds. Registered seed growers are dispersed in all the regions of Ghana. The marketing channel for domestically produced seeds begins with breeding, with the major players being the crops research institutes and the universities. Once the variety is released, foundation seeds are produced. These are sold to registered seed growers (mainly farmers) who multiply and produce certified seeds on a commercial basis. Certified seeds enter the market through wholesale and retail dealer shops, direct farmer purchases for planting, or as security stocks purchased and managed by the Ministry of Food and

Agriculture. Some seeds are imported, mainly from France, Belgium, and Holland in Europe and from Côte d'Ivoire, Burkina Faso, and Mali in West Africa. The main consumers of the imported seeds are the Vegetable Producers and the Exporters Association of Ghana. Generally, access to commercial seeds or hybrid seeds is limited, leading to farmers' reliance on farm-saved seeds. Though there is enhanced access to quality seeds for farmers in the export market channel, it pertains to major exporters and their out-growers and covers few less important vegetables such as okra, turia, and bitter gourd. While the cost of commercial seeds is a factor, their availability at market locations where they are easily accessed by smallholder farmers as well as information on their availability is seen as a major constraint.

Few large private companies, such as Wienco, Chemico, and Dizenghoff import and distribute agrochemicals in Ghana, following the liberalization of the agrochemical imports in 1991. These firms have outlets for direct delivery to registered wholesalers and independent dealers, who then distribute them to the network of rural retailers in the districts and farming communities. Retail outlets are generally agrochemical shops operated by individuals such as the agrochemical sellers. The overall retail network of the country is not well-developed. Most wholesalers and retailers are concentrated in urban centers, forcing farmers to travel long distances to purchase agrochemicals. Another important challenge in the input supply system is the low availability and knowledge of the appropriate use of chemicals, both fertilizer and chemicals for vegetable production. Farmers have difficulties purchasing affordable and reliable chemicals that match their needs.

Access to and mode of transport as well as infrastructure for cold storage are critical in the supply chain. This is particularly important in the export marketing channel due to the short shelf-life of vegetables, and the need for harvested products to reach consumers in a shorter time, preferably within the same day. In the Ghanaian export market channel, once the product has been harvested, usually early in the morning, they are sorted, graded, and packed in an open non-cooled truck to be transported to the international airport in Accra for shipment to Europe. Due to inadequate infrastructure for cold storage at the farm and

throughout the logistical processes, it is required that drivers get to the airport on time for the shipment to be loaded onto the planes the same day. The transportation system is, however, a challenge. There is a limited network of access roads to the rural communities where a greater part of the farming takes place and thereby disconnect farmers from potential buyers. Also, the majority of buyers rely on commercial transport, which is either difficult to access or hardly affordable, especially during peak production seasons. A common practice is that a group of itinerant buyers organize one commercial vehicle and travel to farming communities on specific weekdays.

## **2.2 The vegetable sector institutions, quality, and safety regulations**

Two major associations, in conjunction with the Plant Protection and Regulatory Service Division (PPRDS) of the Ministry of Food and Agriculture (MOFA), play an important role in regulating vegetable production and exports in Ghana. They include the Vegetable Exporters and Producers Association of Ghana (VEPEAG) and the Ghana Association of Vegetable Exporters (GAVEX). Membership of VEPEAG includes farmers and exporters who aim to enhance the production and export of good quality and safe vegetables. Their activity includes periodic training for members and linking member farmers to potential buyers. GAVEX aims to establish Ghana as an important exporter of high-quality vegetables by collaborating with government agencies and NGOs to train members on GlobalGAP principles and other market standards. The PPRSD is the national institution mandated to implement, coordinate, and regulate the plant protection services needed for the country. An important service they provide to the vegetable export sector is to safeguard the quality and safety of crops from losses by pests and diseases and capacity building in phytosanitary issues.

The Ghana Green Label Certification is the Ghanaian fresh fruits and vegetable market-accepted standard for safe fruits and vegetable production, postharvest handling, distribution, and environmentally sustainable agricultural practices. It is an initiative of the country's Ministry of Food and Agriculture in collaboration with GIZ's Market-Oriented Agriculture Program, the Ghana Standards Authority, and stakeholders in the fruits & vegetable sector. The scheme which was launched in 2019 was in response to persistent

public demand for an assurance of the quality and safety of fruits and vegetables they purchase on the Ghanaian market. Ghanaian fruit and vegetable farmers including those serving the international market segment face challenges selling their products due to food quality and safety issues. As shown in an earlier section, domestic supermarkets must resort to imports due to a lack of assurance of the quality and safety of domestic vegetables. The goal of the scheme, therefore, is to help farmers improve the quality and safety of fruits and vegetables in the domestic market. All actors in the value chain including farmers, transporters, traders (wholesalers and retailers) are required to subscribe to the scheme. Certification is an indication that one has complied with the requisite production and distribution systems that ensure that safety and environmental sustainability are not compromised throughout the value chain. The focus of the Ghana Green Label Certification is on the domestic market. However, the scheme is expected to serve as an entry point for local farmers who want to access the international market.

Food safety standards, including public regulation and private standards, are meant to ensure that food is safe at all points along the value chain, both in the international market and within national markets. These are series of stringent public requirements, including marketing standards, labelling requirements, and conditions regarding contamination in food, general hygiene rules as well as traceability requirements. Moreover, private standards imposed by large food companies, supermarket chains, and non-governmental organizations play a considerably important role in the food trade (Henson and Reardon, 2005). Food standards increasingly extend beyond food quality and safety specifications to entail ethical and environmental concerns. Although private standards are not legally binding, they have become *de facto* mandatory, due to their insistence by a considerable number of large firms. Ghanaian vegetable exporters are required to attain these food safety standards before they can supply to the international market. While efforts are being made by the vegetable sector institutions to get farmers to be compliant with these regulations, achievements to date have not been encouraging. Issues relating to food safety and quality and rejections of vegetables at entry points into the international market persist.

### **2.3 Pricing mechanisms in the Ghanaian vegetable value chain**

The Ghanaian vegetable market is characterized by perfect competition. Vegetable prices are generally determined by the market mechanism through an interplay of supply and demand between various intermediaries at different nodes of the value chain. Apart from the general price mechanism, Ortiz *et al.* (2010) found in their analysis of market reforms and food distribution systems in Ghana that some price control mechanism also exists in the market and are employed usually during periods of excess production to the benefit of traders, particularly wholesalers and retailers. This involves price controls by ‘Market Queens’. For example, Drechsel and Keraita (2014) observed in a study of urban vegetable production in Ghana that ‘Market Queens’ can influence product prices by controlling the volume of product supply to the market. Price control may not only be an outcome of quantity regulation by ‘Market Women’ but also through price collusion mechanisms and cartel power of traders at the farm gate due to their knowledge of existing market conditions, as was observed by Abdulai *et al.* (2017). Despite these controls, farm gate price is generally high during the period described as minor season, with a characteristic dryness and low production. In recent years institutions such as the Ghana commodity exchange provides a trading platform for buyers and sellers, facilitating fair product prices for farmers. Also, Esoko, a private market data institution provides information on weekly market prices. These institutions are, however, focused on grains, tubers, and cash crops.

### **2.4 Constraints in the vegetable value chain**

Apart from the input market constraints described in section 2.1.6 farmers face output market constraints. A major constraint involves limited access to buyers who can offer fair prices for their products. Also, in examining constraints in the Ghanaian vegetable supply chain Djokoto *et al.* (2017) observed that farmers lack access to market information and suffer from high post-harvest losses. Apart from contract farming, there is a limited institutional arrangement that enhances farmers’ access to the market. While the market may be non-existent due to glut at certain seasons of the year, in most cases it is due to the lack of connection between buyers and farmers. These are usually evident in scarcity and higher demand for vegetables in some regions of the country while in certain regions farmers lament over lack of market. Another constraint to market access relates to farmers’ inability to comply with the voluntary quality and safety requirement of the export market,

which has become an important marketing channel for Ghanaian vegetables. The need for the resolution of these constraints provides the basis for contract farming in the supply chain.

## **2.5 Incentives for contract farming in the Ghanaian vegetable value chain**

As has been shown in earlier sections, Ghanaian vegetable farmers are constrained by inadequate access to credit, input market failures, inadequate access to credit, lack of knowledge in requisite vegetable agronomy, and market entry barriers. Vegetable contract farming in Ghana promises farmers incentives that allow them to overcome many of the market failures and challenges they face in the market. Thus, incentives come in the form of production inputs, guaranteed market, and output price. The coverage of these incentives, however, varies among contracts depending on the resourcefulness of the contractors and their retail or processing requirements. Inputs credit, free extension service, and training in Good Agricultural Practices (GAP) are components of many contractual arrangements, particularly in the processing, export, supermarket marketing channels. However, many farmers can finance their production through personal savings, soft loans from family and friends, and microfinance loan schemes. The guaranteed market promised by a contractual arrangement is the most attractive incentive for farmers due to the systemic challenge of accessing a ready market for fresh farm products in Ghana. To the buying firm, a major motivation for using a contract is to secure the right quantity and quality of the product for their processing or retail outlets.

To conclude, this section described the vegetable marketing system in Ghana, as a network of farmers (sellers), buyers and intermediaries (wholesalers and retailers), and similar actors engaged in the fresh vegetable trade. The nature of the value chain and regulatory institutions such as the 'Market Queens', food safety, and quality standards as well as supporting services including inputs provision and transport have been described. The review shows that the upstream industry has many smallholder farmers who lack the requisite knowledge, technology, and resources to produce safe and quality vegetables demanded by the market. Specifically, farmers have limited access to quality seeds, other agro-inputs, logistics, and infrastructure for vegetable production. While a contract

between farmers and buyers can help address these constraints in the value chain, the prevalence of side-selling prevents further integration along the food chain. There is an inadequate investment by buying firms in infrastructure and production support services in contract farming arrangements, due partly to the fear of hold-up by farmers through side-selling. The next section presents a review of the theoretical basis for contract farming. Then, having understood that opportunism in transactions can be influenced by uncertainties, chapter four presents a conceptual framework for the choice of contract terms that reduces side-selling in the vegetable supply contract.



## CHAPTER THREE

### Review of Vertical Coordination

#### 3.1 Introduction

In their examination of contract farming and other market institutions for the development of the agricultural sector in developing countries, Catelo and Costales (2008) argued that the active and sustainable participation of smallholder farmers in the rapidly growing and changing global food chain is a potential pathway for rural income growth and development. There are hosts of barriers, however, that smallholder farmers need to overcome, on their own, to participate in the global agri-food market. Structural transformation in the agricultural sector of developing countries has seen the emergence of contract farming as a potential route by which smallholders can be integrated and take advantage of opportunities in the global food chain. Nonetheless, as shown in the previous chapter, contract farming in African markets continue to face challenges, notably contract breach that erodes the potential advantages of the intervention. This section presents a review of a theoretical framework underpinning contract farming. The framework focuses on the issues that form the basis for the formation of contracts and how the design of contracts can affect compliance.

The theoretical foundation for vertical coordination, a generic term encompassing contract farming can be traced to three competing and complementary schools of thought, namely firm behaviour, property rights and agency behaviour, and industrial organization. These presents alternative approaches in explaining why firms vertically integrate and enter a contract, rather than use the spot market for transactions. Despite some criticisms, such as incompleteness in terms of its explanatory power in empirical analyses, transaction cost economics has been described as a suitable framework for examining contract farming. For example, Da Silva (2005), in examining the drivers and the theory of the growing role of contract farming in agri-food systems development argued that transaction cost economics has been the dominant theoretical framework for the analysis of contract farming. Empirical studies examining contract farming in developing countries such as the typology of contract farming arrangements by Mugwagwa *et al.* (2020) in Zimbabwe and vertical coordination

in the agri-food industry and contract farming by Rehber (2000) in the USA and Turkey have used the transaction cost economics framework.

The theme of transaction cost economics is that market exchange between two independent agents entails costs. These costs comprise ex-ante information or search and negotiation costs. For example, a buying firm must search and evaluate suppliers and determine transaction terms while a producer must search for price information, in the food chain. Also, costs arise from ex-post monitoring and enforcement of transactions. Transaction cost emerges from economic agents' bounded rationality, incomplete and asymmetric information about transaction characteristics (Kherallah and Kirsten, 2002; Rindfleisch et al., 2010). Bounded rationality in the sense that, in as much as agents want to make a rational decision, there exists a physical limitation on their ability to evaluate accurately every possible contingency. On the other hand, agents tend to behave opportunistically and may free ride on each other in transactions (Williamson, 1979). The combined effect of bounded rationality and information asymmetry is the uncertainty of transaction and potential moral hazard. Thus, transaction cost economics recognize that market transactions are fraught with moral hazards and agents can't arrive at a socially efficient welfare maximizing solution under the free and competitive market environment. Precautionary measures that are required to mitigate losses due to opportunistic behaviour entails cost and, therefore, establish the need for alternative measures, other than the free market, to coordinate a market exchange. Economic institutions, such as contracts, must, therefore, evolve to reduce the cost associated with using the market mechanism.

According to the theory, the characteristics of the transaction determines the extent of opportunism, and the subsequent coordination form that may be needed. Williamson (1979) identified three important transaction characteristics. The first transaction characteristic is uncertainty, which is described as imperfect knowledge about an event and its outcome. A party to a transaction may not be certain about the probable action of the other party, assuming an opportunistic behaviour. Uncertainty about a transaction can assume variable nature. For a buyer, it can be uncertainty about the quality of a good or service, a reliable supply or a supplier, quantity of a good, or timeliness of delivery. For the

seller, it can be a search for a reliable buyer. As noted by Hobbs and Young (2000), both agents can face price uncertainty. The literature notes two forms of uncertainties. In the study of influence of uncertainties on the choice of a business relationship, Li *et al.* (2018) observed that uncertainty can be environmental, such as factors that affect production in the case of agriculture, or behavioural such as contracting partners' opportunistic behaviour.

Asset specificity, the second transaction characteristics, arises when an economic agent must undertake investment to engage in an activity purposely to meet the requirements of another party. In this case, the value of the asset is maximized within the specific transaction but has little or no value outside. According to Williamson (1988), asset specificity entails physical, site, human, temporal, and brand capital specificity. According to Klein *et al.* (1978), investment in these specific assets creates appropriable quasi-rents and exposes the investor to opportunistic behaviour. The beneficial agent can capture those rents by reneging on the exchange agreement. Thus, asset specificity creates hold-up problems. Masten (2000), in examining transaction cost economics and the organization of agricultural transactions, however, observed that not all specific assets are relevant to transactions since they may not be able to create hold-up problems. Relevant specific assets must influence the choice of transaction governance. For example, in the vegetable chain, relevant specific assets may include physical and temporal asset specificity. Physical assets specificity involves investments in specialized equipment and infrastructure that are designed for a particular transaction and have limited value outside the transaction. An investment in greenhouse technology for vegetable production or GLOBALGAP certification is a specific investment since it will be difficult for buyers to find alternative certified buyers and the cost of switching to other farmers will be high (Reardon and Zilberman, 2018). Temporal asset specificity emerges where timing and coordination are important to the transaction (Mugwagwa *et al.*, 2020). This includes when a product is valuable only when it reaches the user within a limited time. Vegetables and many other agricultural products have temporal asset specificity because of their perishability and seasonality. Realizing that timely delivery is important, the farmer can hold-up the buyer by deliberately withholding delivery and seeking to renegotiate the terms of the buying agreement to extract additional gain from the transaction.

Frequency of exchange, the third transaction characteristics, refers to the number of times a transaction is expected to occur. There are alternative explanations for how the frequency of transaction affects the choice of the transaction governance structure. According to Williamson (1979) explanation, if a transaction is a one-off, it is less efficient to devote significant resources to coordinate and control activities. The loss from free-riding may not justify the cost of a special arrangement to coordinate transactions. However, if the transaction is recurrent and involves higher uncertainty there is a greater chance of opportunism and the aggregate cost of opportunism will be higher without a transaction governance structure. Alternatively, in his examination of solutions to the risk of a hold-up in the Canadian ethanol supply chain, Weseen *et al.* (2014) argued that highly frequent transactions build trust among contracting parties so that it is not necessary to resort to hierarchical governance.

The transaction cost economics asserts that whenever the characteristics of the transaction are such that direct market exchange leads to opportunism and prohibitively high transaction costs, it is more efficient for the firm to remove transactions from the market and engage in vertical coordination. The transaction characteristics must determine the form of coordination. Williamson (1975) identified four transaction coordination forms namely, classical contracts (spot markets), neoclassical contracts, bilateral relational contracts, and unified relational contracts (vertical integration). The differences among these depend on the extent of internal or hierarchical control they provide. A transaction characterized by a low level of uncertainty lends itself to a spot market transaction while a highly uncertain transaction is better suited for a higher coordinated governance form. Further advances in the transaction cost literature expand the transaction governance forms into five. These, according to Peterson and Wysocki (1997), include spot market transaction, specification contracts, strategic alliance, formal cooperation, and vertical integration. Catelo and Costales (2008) observed that the relevance among these transaction coordination governances to contract farming is the specification contract, strategic alliance, and bilateral cooperation.

Transactions between agribusiness buying firms and farmers in the Ghanaian vegetable value chain described in chapter two are characterized by uncertainty, asset specificity, and frequency. Side-selling, which is the subject of this thesis, is behavioural and could be influenced by other environmental factors that affect vegetable production. Therefore, the uncertainty of the transaction is the most suitable framework for the analysis of the choice of a governance structure if the goal is to limit side-selling.

### **3.2 Review of contract farming**

Contract farming is a transaction coordination governance in agricultural production and marketing. According to Bijman (2008b) and MacDonald (2015), it is useful in three major aspects. First, as a coordination device, it enables an agribusiness buying firm to coordinate the production processes of a farmer to ensure the right quality and quantity of commodities are secured. Second, contract farming allows the buyer to motivate producers to undertake a specific production activity through the provision of incentives. Incentives can include mechanisms that penalize non-performance. The third aspect involves the allocation of financial risk (fiduciary), which specifies measures that mitigate the risks of farmers from production losses.

Milgrom and Roberts (1992) and Bogetoft and Olesen (2004) captured these aspects in two broad objectives; coordination and motivation. The choice of any of these objectives is tied to the characteristics of the contract; that is, the expected output, the characteristics of the product, and the target market for the product. The motivation aspect involves the provision of incentives for risk-sharing between parties. This means through contract farming an incentive could be offered to farmers to produce a product requiring substantial investment that cannot be afforded by smallholders. Coordination on the other hand ensures greater involvement of the firm in the production process and, therefore, comes into play if the expected product is such that close monitoring of producer is needed. For example, perishables such as fruits and vegetables would require effective coordination between the producer and the buying firm.

Mighell and Lawrence (1963) and Minot (1986) provided a more specific description of three types of contracts that are useful in addressing categories of transaction coordination problems in contract farming. These include market specification, production management, and resource provision contract. The market specification contract addresses coordination problems arising from marketing information asymmetry. To the firm, it addresses information asymmetry concerning the available market, quantity, quality, seasonality of demand, and prices. To the farmer, it addresses the transaction cost of finding a buyer. Under this arrangement, the farmer is mostly responsible for agronomic practices and the cost involved in undertaking those practices from seeding up to the delivery of the product and does not receive production support from the buyer. He is solely responsible for all production risks (Bijman, 2008b). This type of contract is suitably applicable if the farmer has the resources to acquire recommended production inputs and has considerable knowledge in the requisite agronomic practices necessary to produce the commodity. Again, the arrangement suggests limited coordination between the buyer and the farmer. Therefore, for high-value horticultural crops for which the output market demands absolute adherence to food safety and quality standards, market specification contracts may not be suitable particularly for smallholder producers.

Production management contract addresses coordination problems arising from production information asymmetry concerning recommended production technology and agronomic practices for increased productivity, product quality, and timeliness of product delivery. This transaction coordination governance allows the firm to have access to information on-farm practices which enable him to assist farmers in the execution of appropriate production practices to attain higher quality products. This arrangement, according to Bijman (2008b), is mostly applied when the buyer bears significant market risk, usually emerging from the commodity's market regulations.

Resource provision contract is meant to resolve transaction coordination problems between transaction partners in respect of imperfections or incompleteness in the markets for credit and inputs. The contract allows the firm to not only recommend appropriate production inputs but to provide them together with other technical advice on credit. Thus, a resource

provision contract, involves the highest control of the production process at the farm level, having proprietary rights over inputs, technology, and output. Because of the firm's involvement in the provision of input, the contract becomes most appropriate to use when the quantity and quality of the expected output can significantly be impacted by input usage. By committing to input provision, the buyer shares in the production risk borne by the farmer which leads to increased buyer commitment to the contract agreement such that failure to show up to purchase the contracted commodity, reported in some contracts, is not in his best interest. A contract must have terms that define the obligations of each party to the contract. The intensity of coordination will depend on the terms specified by these contract types. Contract terms may originate based on the target output and processes involved in achieving these outputs and can range from production practices through delivery methodologies to the enforcement approaches required to achieve performance.

### **3.2.1 Review of empirical studies in contract farming in developing economies**

Various studies have examined contract farming in the food chain in developing countries. The following reviews those relevant to this study. Abebe *et al.* (2013) examined contract attributes preferred by potato farmers in Ethiopia. His study was premised on the fact that allowing farmers to determine their preference for contract terms in a contractual arrangement would enhance contract performance. In this study, producers indicated a preference for contract attributes that address market failure through the provision of inputs, quality seeds, and technical assistance. These attributes connote uncertainties of the input market and are better addressed with resource providing contract. Also, regarding the output market, farmers showed a preference for variable output price, as a safety against the risk of underpayment once they are locked in a fixed price contract (Holly Wang *et al.*, 2011; Abebe *et al.*, 2013). A contrary observation involving preference for a fixed price, which provides a hedge against price volatility has, however, been documented. In a study of alternatives for managing risks in a potato contract in India, Tripathi *et al.* (2005) found that buyers preferred a fixed contract price. Similarly, in his examination of small farmers and big retail chains in Nicaragua, Michelson *et al.* (2012) found that farmers participated in a contract with Walmart that offered insurance against price volatilities even though the mean net profit from the contract was lower than the mean net profit in the traditional market. The survey, however, used historic data in which farmers did not have the

opportunity to observe ex-ante the expected net profits before deciding which supply channel to participate in. Having observed ex-post that the traditional spot market offered a higher profit than the insured price in the Walmart channel it would be interesting to understand farmers' preferences in a subsequent transaction.

The diversity in preferences could have geographical as well as trust implications. For example, as Abebe *et al.* (2013) noted, Ethiopian farmers' decisions are informed by the risk of buying firms dishonouring the payment of a promised contract price. In terms of product quality and price, Ethiopian farmers preferred contracts that specify the delivery of variable product quality and offer different prices for different qualities of the product. This implies a higher quality product will attract a higher price.

Harou and Walker (2010) researched the Ghanaian pineapple sector and reported on farmers' behaviour and the forms of a contractual agreement. He observed that farmers regretted accepting verbal contracts from buyers, and they insisted on not entering a contract in the future without a written agreement. They showed that verbal agreements in the pineapple chain were not honoured by buying firms, and in some instances, buyers abandoned contracts at the last hour when farmers were preparing to harvest pineapples. Similarly, Robinson and Kolavalli (2010) investigated tomato processing in Ghana and found that farmers producing for the Pwalugu tomato factory had their product abandoned by the firm. Farmers had to resort to the spot market to sell their products. Harou and Walker (2010) observed that, due to contract breaches, farmers in the pineapple sector have shown preferences to join farmer-based organizations or farmer groups to enable them to demand written contracts from firms. Also, in a survey of five buying firms in India, it was revealed that only 46% of farmers had verbal agreement with firms (Narayanan, 2010a). These observations are contrary to the generally held belief that verbal contracts are preferred in the agricultural supply chain.

Ashraf *et al.* (2009) and Harou and Walker (2010) observed increased use of farmer-based organizations in contract farming. Contracting through farmer-based organizations



guarantees a certain minimum quantity of commodity with a comparatively reduced transaction cost associating with collecting small volumes of produce from many farmers. Again, a farmer-based organization would have the capacity to respond to a contract breach by the buyer. Farmer-based organizations have been shown to play important role in contract farming, providing technical training, increasing modern input usage, and enhancing farmers' capacity in the production of high-value commodities (Bachke, 2010; Barrett *et al.*, 2012). They also help subsidize farm operations, procurement, and usage of farm facilities that would otherwise be out of reach by individual farmers (Fold and Gough, 2008; Bachke, 2010). The contract farming study by Barrett *et al.* (2012) shown increased participation by farmers in contract farming schemes involving a neighbouring buying firm. Thus, there are considerations for the buyer's reputation and social connections in the farmers' decision in choosing the buyer from whom to accept a contract.

The distance between a firm's location and contract farmers has been shown to depend on the nature of the contracted commodity and the geographic requirement. According to Barrett *et al.* (2012) with commodities requiring processing in a few hours after harvest, farms are located close to the buying firm. He found that in India gherkin farmers are located within a 60-100km radius of the firm. To reduce the risk of side-selling, Barrett *et al.* (2012) observed that some firms locate and procure commodities from remote areas. In the export pineapple industry in Ghana, they found that pineapple cultivation areas are not far from the international airport in Accra and major container ship seaport in Tema.

In contract farming case studies of developing countries, Barrett *et al.* (2012) observed that farmers bear greater downs side risks, including the risk of non-payment and product rejection due to claims of less quality. Buyers, on the other hand, complained of side-selling and failure to deliver the agreed contracted commodity. Romero Granja and Wollni (2019) investigated opportunistic behaviour and trust between farmers and buyers in the Broccoli sector in Ecuador and observed hold-up including price cuts, payment reductions and deliberately increased grading standards by buying firm. He observed that, as part of contract agreement, farmers were supposed to receive payment for sold commodity within 2 weeks after sale.

Contract duration would usually vary from contract to contract, especially when different crops are involved. For example, a typical contract farming duration in the wine grape sector has been observed to cover three to five years and frequently ten years (James and Edmonds, 2000; Anderson, 2001). For short term crops such as vegetables, contract duration is mostly one production season but are usually renegotiable or automatically renewed at the end of the season (Eaton and Shepherd, 2001a; Bijman, 2008a).

Bowles and Gintis (2002) and Keefer and Knack (2008) observed that customs, norms, and social values existing in the community frowns on opportunistic behaviour and leads to contract compliance. In a study of trust in contracts, Nooteboom (2002) shown that economic incentives inherent in contract design or social incentives derived from a network of current and potential contracting parties were able to ensure contracts are voluntarily honoured. In a study of trust, contracts, and relationship development, Woolthuis *et al.* (2005) revealed that trust emerging from interpersonal care, concern, and benevolence, which are common at the community level, enhances contract compliance.

### **3.3 Summary**

The purpose of this chapter was to review the theoretical basis for vertical coordination. From a brief review of the concepts of vertical coordination, it is argued that the most important reason for contract farming is the transaction cost, particularly the cost associated with the uncertainty of transaction, in the context of this study. Then, the next section proceeded to identify and summarize relevant empirical work in the food value chain. Guided by the uncertainty of the transaction, the next chapter presents a conceptual framework of contract farming aimed at mitigates side-selling.

## CHAPTER FOUR

### Conceptual Framework

#### 4.1 Introduction

This chapter describes a conceptual framework for the choice of contract terms when an agribusiness buying firm aims to guard against side-selling in contract farming. It explains how uncertainties over the characteristics and actions of the agents shape the choice of contract terms. Specifically, this framework aims to explain how contracts are written when the goal is to mitigate side-selling and will be used to guide the empirical analysis in the next chapter. Having introduced the chapter in section 4.1, section 4.2 explains the decision to enter a contract while section 4.3 presents a description of the uncertainties in the agri-food chain that potentially lead to side-selling. Lastly, some mechanisms for informal contract enforcement are presented in section 4.4.

#### 4.2 The decision to enter a contract

One of the reasons to use contracts, from the transaction cost economics perspective, is to reduce opportunism and the costs arising from uncertainties in a market transaction (Williamson, 1979). Other transaction characteristics such as frequency of transaction and asset specificity may lead to a contract, but as Martino and Frascarelli (2013) and Mugwagwa *et al.* (2020) observed, uncertainty has been the most widely held reason for the formation of a contract in modern food chains. A possible reason is that, in addition to the behavioural uncertainties that confront transactions in many markets, agricultural transactions are predisposed to uncontrollable environmental factors such as weather effects, pests, and diseases that affect the quantity and quality of output. There exist, also, volatilities in agricultural market conditions that lead to uncertain output price and demand.

To illustrate how uncertainty affects contract formation and specifically the choice of contract terms, consider an agribusiness buying firm that procures products from farmers for retailing or processing. While the product could be secured in a competitive spot market, there are uncertainties over the sellers' ability to deliver the quantity of the product with the required quality specifications and on time. To reduce these and other transaction costs,

the buyer opts to use a contract. However, when using a contract, the buyer needs to consider moral hazard on the potential opportunistic behaviour of the agents, such as shirking, cheating, and side-selling. In Sub-Sahara Africa and other regions across the globe, farmers often breach delivery contracts, and most have verbal contracts that have limited enforcement. In a study on market institutions in Sub-Sahara Africa, Fafchamps (2004) observed that institutions for public ordering, such as the court, are inefficient, making formal contracts redundant. Thus, there is an implicit side-selling in contract farming, meaning the delivery of the contracted product is not guaranteed by the removal of the transaction from the spot market. The design of the contract is important as it affects how the contract can be self-enforced in an environment of weak public enforcement. This involves a consideration of the transaction uncertainties and the potential incentives they offer for contract breach. Contract terms can then be specified to counteract the effect these uncertainties may generate in contracts. The conceptual model in Figure 4.1 highlights the uncertainties or the issues leading to uncertainties that generate side-selling in the vegetable value chain contracts that will then be discussed in more detail in this chapter.

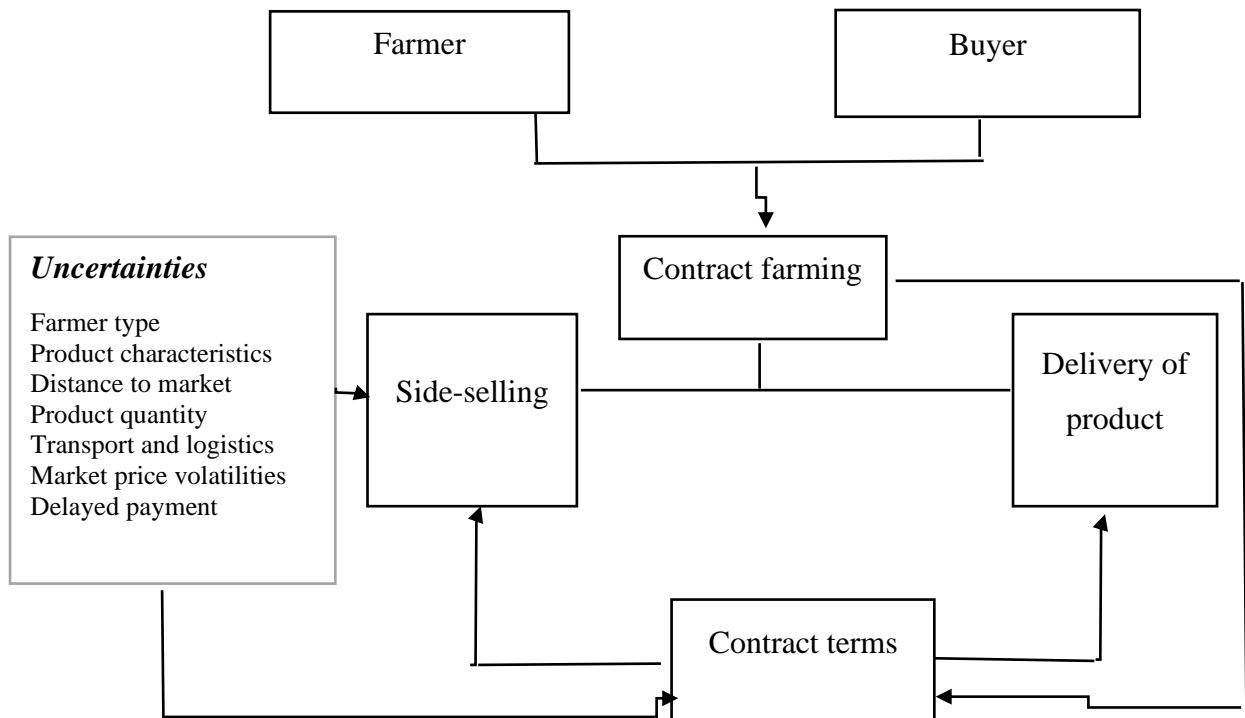


Figure 4.1: Transaction uncertainties and side-selling in vegetable contract farming

As shown in the diagram above, the terms of the contract will either enhance compliance (product delivery) or side-selling by the farmer. Focusing on side-selling, the decision by

the farmer can be traced to the incentives offered by the transaction uncertainties including environmental factors that may affect delivery, and behavioural factors relating to the characteristics and actions of the farmer (Li *et al.*, 2018; Mugwagwa *et al.*, 2020). Also, product-market uncertainty and logistic challenges may affect the farmer's decision to side-sell. Therefore, the contract term choices must be informed by these uncertainties and challenges, as the buyer aims to prevent side-selling. Thus, the framework posits that contract breach could be minimized, and the stability of the contract ensured if contract terms are chosen to reduce the impact of the underlying transaction uncertainties that have the potential to expose the contract to side-selling.

Generally, contract terms are statements of provisions, conditions, or clauses that define among others, the obligations of the contract parties, incentives for performance, enforcement mechanisms, and penalties for shirking (Eaton and Shepherd, 2001b; Melese, 2012). There are generic terms that every contract farming must specify. For example, the contract price, the quantity of product, the quality of the product, and the delivery timelines (Mighell and Lawrence, 1963; Bijman, 2008b). These, however, do not provide a one-size-fits-all model. The buyer can further guard against contract breach by defining other contract terms against the uncertainties. The choice of contract terms must begin with an understanding of the uncertainties and other transaction characteristics that potentially drive side-selling in the market, as described in the following section.

### **4.3 Transaction uncertainties in the vegetable value chain**

Eaton and Shepherd (2001b) observed that the type of uncertainty in a transaction can be related to the physical, cultural, and environmental factors of the transaction location. Also, the availability of production inputs, the logistical requirements for the production and delivery of the product, the product market, and the nature of the product determines the transaction uncertainties. Based on the Ghanaian vegetable value chain description in chapter two, potential sources of uncertainties that may lead to side-selling include, but are not limited to the farmer type, product quantity, product characteristics, distance to market, logistics, transport, market price volatilities, and payment options. Next, how each of these constitutes an uncertainty and must impact the choice of the contract terms is explained.

### *Farmer type*

In line with standard economic theory, farmers are rational and aim to maximize their utility. Thus, they will side-sell in contract farming if that increases their income when the real or perceived risks of punishment are low. This includes when the spot market price exceeds the contract price. Once a farmer accepts a contract he is expected to comply with the agreement. However, opportunistic farmers may take advantage of the guaranteed contract price, and company inputs credit, but side-sell when spot market price increases. Due to bounded rationality, it is difficult for the buyer to determine ex-ante opportunistic farmers. The framework proposed here posits that this behavioural uncertainty can be managed through the choice of contract terms. One of such is to restrict participation in the contract to farmers who are most likely to be compliant. To achieve this, Barrett *et al.* (2012) noted that the buyer can rely on certain readily observable signals of inclination to perform a contract in making contract offers. One of such is the participants' membership of a farmer association. Membership of farmer-based organizations (FBO's), apart from reducing transaction costs, offers group enforcement through peer pressure and limits opportunistic acts by group members. Farmer based associations have sanctioning mechanisms for non-compliant farmers, including termination of their membership. Thus, the first hypothesis of the framework is formulated as:

H 1: Contract farming will involve farmers who are members of farmer-based organizations (FBO) as these organizations provide enforcement against side-selling.

### *Distance to market*

Availability and access to alternative markets present side-selling opportunities to farmers. Therefore, the physical proximity of the contract farms to alternative markets that have demand for the contracted products will offer an outside option to farmers. Delivery of the product becomes highly uncertain if contract farms are closer to alternative markets than they are to the contractor. The buyer can reduce the uncertainty of product delivery due to alternative markets in two ways. First, he may offer contracts to farmers who are located away from alternative markets. As Barrett *et al.* (2012) observed, when buyers contract in remote locations, they face a lower risk of side-selling due to the less opportunity for farmers to access alternative markets. Second, the buyer can reduce uncertainty by locating

closer to the production site. This is more important and practically possible for bigger firms and processors that buy products in large volumes. Therefore, in contract farming in the Ghanaian vegetable value chain, the buyer can guard against side-selling by offering contracts to farmers who are distant away from potential alternative markets. Thus, the third hypothesis is stated as:

H 2: A contract farms will be located distant away from alternative markets as distant farms have less incidence of side-selling.

#### *Variable product quantity*

Variable agro-ecological and weather conditions affect farm output, particularly the yield. Therefore, in production contracts, parties are unable to contract on the exact quantities to be delivered ex-ante. While farm output is observable to the farmer ex-post, when the product has been harvested, the buyer cannot verify the output. The buyer's inability to predict yield ex-ante and the information asymmetry on output even after harvest generates uncertainty about the units of products that the farmer will deliver. The information asymmetry on quantities increases the likelihood of a partial side-selling. One of the ways to reduce the uncertainty and side-selling is to reduce the information gap between the farmer and the buyer and this can be achieved with some degree of success through close monitoring of farm operations. Mighell and Lawrence (1963) and Eaton and Shepherd (2001b) described three types of contracts namely, the market specification, production management, and resource provision contracts. Among these, the production management or the resource provision offers the highest level of coordination and greater firm's involvement in on-farm activities. Production management contracts involve periodic visits of the buyer to the farm, enhance monitoring, and allow the buyer to access useful production data. This can minimize the information asymmetry on output and makes it difficult for the farmer to cheat.

H 3: A contract farming will entail production management and frequent monitoring as opposed to simple marketing arrangements to mitigate the likelihood of side-selling.

#### *Product characteristics*

The more perishable are products and the lower the farmers' storage capacity, the more likely there are post-harvest losses. In these circumstances the potential for side-selling is

high and buyers' access to the contracted product becomes uncertain. Post-harvest losses due to delayed product pickups are common in the food supply chain in some developing countries' contexts, including the Ghanaian vegetable chain. The chances of side-selling are high if the costs of post-harvest losses are borne by the farmer. A contract is, therefore, expected to define provisions to compensate farmers for post-harvest losses caused by delayed or failed product pickup by the buyer. The foregoing leads to the following hypothesis:

H 4: In a contract farming arrangement the buyer will compensate the farmer for post-harvest losses arising from delayed or failed product pick-up by the buyer as doing so lowers the incidence of side-selling.

#### *Transport and logistics*

An important constraint to the Ghanaian vegetable value chain is access to transport to cart products from farming communities to the market. Most farmers do not have a means of transport and must rely on traders to transport goods. A contract may define the allocation of the responsibility for transporting the product from the farm gate to the dedicated receiving center between the farmer and the seller. In the context of the Ghanaian vegetable value chain, a contract usually may require farmers to deliver the product, normally to an aggregation center away from the farm. For smallholder resource-poor farmers without access to a personal vehicle and must rely on commercial transport, this constitutes an inconvenience even if they are reimbursed the transportation cost. Thus, the allocation of the responsibility for product delivery to farmers may lead them to involve another party and increase moral hazard. The foregoing leads to the following prediction:

H 5: In a contract farming arrangement the buyer specifies to take delivery of the product from the farm-gate as he aims to prevent side-selling.

#### *Market price and volatility*

Price volatility in the Ghanaian vegetable markets is a major source of uncertainty that can affect side-selling in contract farming. A contract price may reduce this uncertainty but may also lock the farmers. This is because when they accept a contract in exchange for delivering an agreed amount of product, they reduce their opportunity to increase profits if



market prices become more favourable. Still, in a well-designed contract different price options may be associated with different risks and incentives (Holly Wang *et al.*, 2011). Price options that can be offered in contracts include fixed, variable, flexible, and split price (Eaton and Shepherd, 2001b; Bogetoft and Olesen, 2002). When buyers offer a fixed price on a contract, they bear the responsibility of all market risk while farmers only bear the production risk. A fixed price option increases the buyer's risk exposure, especially when downstream markets are volatile. However, unlike farmers, buyers have access to tools that enable them to manage some level of risks. An extreme alternative to a fixed price option is a variable price. The choice between a fixed price and a variable price involves trade-offs, which may generate moral hazard from either party. To the farmer, a fixed price option serves as insurance against reduced price risks but offers less reward when the ex-post spot market price increases above the fixed contract price. Farmers' price risk exposure also increases if the contract specifies a variable price option (Wolf *et al.*, 2001). However, a variable price option based on the spot market price removes moral hazard problems, such as side-selling arising from market price volatility.

Flexible price is based on a calculation using an agreed formula and considers changes in the product's retail price as well as the buying firm's cost for value addition or processing. Thus, the buyer must retail the product before farmers can receive payment. This arrangement does not guarantee a fixed income for farmers, as income can be affected by the buyer's retail market price. Moral hazard due to spot market price exceeding contract price is eliminated. However, a dishonest buyer can cheat farmers by failing to declare the actual retail price and his retail or processing expenditure. Therefore, a flexible price can generate conflict between the parties.

Split pricing is a mixture of a fixed price, which is based on an agreed base price, and a flexible price, which is based on the prevailing retail market price. It ensures that a proportion of farmers' income is protected against reduced price risk while the variable component allows the farmer to benefit when the ex-post spot market price rises above the fixed price. A contract can also fix a price based on spot market values. This form of pricing eliminates income guarantee for farmers but enables them to take full advantage of higher

market prices. Due to the volatility of market price for vegetables in Ghana, a fixed price will lead to side-selling by the farmer when the market price increases. This leads to the following hypothesis.

H 6: A contract farming will involve split pricing, where contract price consists of a fixed and a variable component, as this will reduce side-selling arising from higher spot market price.

#### *Payment options*

Payment options define when and how farmers receive payment for the products delivered. Contracts may specify delayed or deferred payments, where payments are received in few days to weeks after product delivery or may entail immediate cash payment following delivery (Eaton and Shepherd, 2001b). Deferred payments can be the most convenient option for buyers. Particularly for those with less financial power and or low cash flow. Similarly, the buyer needs time to calculate farmers' loan deductions in the case of a resource provision contract. Deferred or delayed payment, however, may give rise to side-selling especially in an environment of volatile spot market price. The spot market price at the time of payment, in a deferred payment arrangement, could far exceed the contract price at the time of concluding sale transactions which will trigger side-selling in subsequent harvests. For farmers with limited alternative sources of income and limited cash flow, a delayed payment is inconvenient and can lead to delivery breaches. The foregoing lead to the following hypothesis:

H 7: A contract farming will involve an agreement for immediate cash payment when the farmer delivers the product as this will decrease the temptation to side-sell.

#### **4.4 Contract enforcement**

Enforcement of a contract against side-selling can be affected by the form of the contract, which can be a written or verbal form. A contract involving a written agreement typically specifies all terms of the contract, including incentives for performance and penalties for shirking. While written contracts can be enforced in a court, the incompleteness of agricultural contracts emerging from the difficulty in specifying all contingencies ex-ante (Baker et al., 2002), and the resultant difficulty in determining breach by a third party will make formal enforcement problematic. In examining contract farming theory and practices

and the contractual vegetable markets in Ghana Eaton and Shepherd (2001a) and Poole *et al.* (2003) respectively, argued for registration of contract farmers even if breaches cannot be resolved in the court. Registration in contracts refers to a signed confirmation from the farmer indicating a willingness to have a contract with the buyer. Even though a simple registration cannot be enforced in a court, it may induce moral obligation and trust between the buying firm and the seller and serve as a reference for determining performance. Poole *et al.* (2003) argued that a register of buyers and farmers with a certification of identity, and provision for the withdrawal of certificate for contract breach can be useful.

Informal verbal contract relies on repeated interaction and reputational mechanism for enforcement. Meaning parties engage in long-term repeated relationships and have the opportunity to quit the relationship for free-riding. According to the relational incentive contracts studies by Levin (2003), this kind of contract can promote trust and provide incentives for parties to comply with their obligations. Contract enforcement through reputation is achieved through the concern for reputational loss if the contract is breached. It can be bilateral; thus the loss of reputation is known only to the buyer and the farmer or multilateral, meaning the loss of reputation become known to a group of people or organization to which the agent (farmer or buyer) belongs. As argued earlier in this chapter formal institutions for contract enforcement are weak or non-existent in Sub Sahara African markets. Also, the loss from a contract breach may not be large enough to justify the cost of court resolution. Therefore, it is expected that agricultural contracts will involve informal verbal agreements and farmers will be offered long-term repeated contracts. Informal institutions such as rules, legal and social norms could also offer enforcement particularly in Sub-Sahara Africa, where they are much valued. In the Ghanaian context, opinion leaders such as community chiefs and ‘Market Queens’ are an important part of the informal institution, whose authority is effectively exercised over subjects in their communities. Consequently, it is expected that the buyers will offer contracts to members of their community. This leads to the following hypotheses:

H 8: A contract farming will involve registered and certified farmers whose certificates are subject to revocation for contract breach to deter side-selling.

H 9: A contract will specify long-term repeated arrangement to serve as an enforcement mechanism against side-selling.

H 10: As informal enforcement against side-selling, the buyer and the farmer in contract farming will come from the same community.

#### **4.5 Summary**

This chapter proposed a conceptual framework for the choice of contract terms when the buyer aims to mitigate side-selling in contracts. The framework shows that while a contract reduces transaction costs due to uncertainties and other transaction characteristics, side-selling may still occur in contracts if the contract terms fail to adequately address the uncertainties. As explained in section 4.2, the choice of contract terms must be shaped by the uncertainties that potentially give rise to side selling if the contract aims to mitigate side-selling. Section 4.3 explained the uncertainties that may lead to side-selling in the context of the Ghanaian vegetable value chain, arguing that understanding them is useful in determining appropriate contract terms. In section 4.4, contract enforcement strategies were discussed focusing on how informal contracts can be enforced against side-selling. The next chapter tests the hypotheses in this framework using survey data from the Ghanaian vegetable value chain contracts.

## **CHAPTER FIVE**

### **Contract Terms and Side-Selling in the Ghanaian Vegetable Value Chain**

#### **5.1 Introduction**

This chapter empirically tests the conceptual framework described in chapter four by investigating contract terms in vegetable contract farming in Ghana and the extent to which these terms address uncertainties and mitigate side-selling in the value chain. It also explores farmers' preferences for contract terms, their views on side-selling, and contract enforcement strategies in the value chain. The chapter starts with a description of the methodology of the study, presented in section 5.2. The results of the study and discussions are presented in sections 5.3 and 5.4, respectively. Section 5.5 concludes the chapter, which is the first part of the study.

#### **5.2 Methodology of the study**

This section explains the methods employed in investigating contract terms in the Ghanaian vegetable value chain and how these terms affect side-selling. First, it gives an overview of the study area and the reasons for the choice of this area for this research. Next, the sampling procedure, followed by the data collection method is presented. Specific methods employed in the analysis of the survey data are also shown.

##### **5.2.1 Study area**

The study took place in four major vegetable producing regions in Ghana, namely, the Greater Accra, the Volta, the Eastern, and the Central regions as shown in Figure 5.1. These regions were selected for the study because they specialized in fresh vegetable production, export, and processing. The locations are close to major lakes and dams for irrigation farming and other vegetable production infrastructure allowing all-year-round vegetable production. Also, these regions are close to the Greater Accra metropolitan area, home to about 2.5 million urban dwellers and foreign expatriates, where there is a high demand for vegetables. These regions are also close to the nation's international air and seaports, increasing access to the European Union markets. Discussions with VEPEAG before the survey revealed that there is an increased vegetable contract farming in this area than the

rest of the regions in Ghana. According to this institution, however, there are continuous reports of side-selling in contracts in these areas that continue to hurt and disrupt many contract farming arrangements. The area is thus suitable for the examination of side-selling in the value chain contracts.



Figure 5. 1: A map of Ghana showing the study area

## 5.2.2 Sampling and data collection

Data were collected from 240 vegetable contract farmers comprising 120 each from the traditional<sup>1</sup> and the export marketing channels between June and July 2016 using a multi-stage sampling strategy. The first stage involved an identification of four major vegetable producing regions in Ghana followed by a random selection of major vegetable producing communities within each of the identified regions. This was done with the help of the VEPEAG who provided a comprehensive list of communities and farmers in the export marketing channel. The selected regions and the number of communities identified in each region are shown in Table 5.1. Normally, in every vegetable producing community in Ghana, the number of farmers supplying vegetables to the export market are lower than farmers supplying the traditional marketing channel. Therefore, in the survey, a community was considered as a major vegetable producer if at least 10 farmers were participating in the export market channel in the community. This consideration was important to ensure that the sampling captured enough farmers in the export marketing channel to enable comparative analysis with the traditional market channel.

Table 5. 1: Overview of sample areas

<b>Regions where data were collected</b>	<b>A major vegetable growing community</b>	<b>Randomly selected communities</b>	<b>Export marketing channel</b> Number of Farmers	<b>Traditional marketing channel</b> Number of Farmers
<b>Eastern</b>	11	3	30	30
<b>Greater Accra</b>	5	3	30	30
<b>Volta</b>	6	3	30	30
<b>Central</b>	5	3	30	30
<b>Total</b>			120	120

The next stage of the survey involved the use of a convenient sampling to select 10 farmers each from the export and traditional market channels to participate in the survey. Convenient sampling was used because only farmers who had a contract running at the time of the survey must be sampled. As it became obvious on the field during the pre-testing of the questionnaire, and from discussions with the leadership of VEPEAG and

<sup>1</sup> Traditional market refers to the open-air food markets most common in Sub-Saharan African.

officials from the Ministry of Food and Agriculture (MOFA) in the various communities, not many farmers had contracts at the time of the survey.

Data were collected through a face-to-face interview using a structured questionnaire. Interviews were conducted in the local Ghanaian language (Twi) in the Greater Accra, Central and Eastern Regions. In the Volta region, however, the interview was conducted in ‘Ewe’ a local language of the people of the region. Though many of the respondents could speak English, the use of the local language provided a better understanding of the choices respondents needed to make and ensured they could interact fluidly and openly with the researcher, and seek clarification for questions they did not understand before responding to them. This was important to minimize biases. The questionnaire solicited from farmers among others, terms that governed their contracts as well as terms they would prefer had been included in the contract. Their views on side-selling and if they had ever engaged in the practice were also solicited. Interviews were always preceded by a brief period of introduction in which general issues bothering farmers in the vegetable supply chain were discussed. The purpose of the study and the potential contribution it could make to government policies in addressing supply chain constraints that confront the vegetable sector was reiterated. Normally, a farmer may not reveal a negative practice he or she has indulged in. During the survey questionnaire pre-testing, however, it was observed that farmers openly discussed side-selling and admitted their engagement in the practice when they were asked. They were quick to add that the practice is motivated by the failure of the buyer to show up, sometimes, to purchase the contracted product. In the main survey, before asking whether they had engaged in side-selling in the previous 5 years, farmers were first engaged in a discussion about contract breaches by buying firms and how it impacts their relationship. This coupled with the introductory discussions made farmers comfortable and confident to give frank responses about their engagement in side-selling. It is, therefore, reasonable to conclude that responses are of enough quality and relevant to the study. Farm operations and socio-economic variables were also collected from farmers. Before data collection, a key informant interview with the leadership of the VEPEAG and GAVEX was conducted.



### **5.3 Identification of contract terms and their effect on side-selling**

This section describes the procedure used to identify contract terms in the vegetable supply chain contracts as well as the methods for identifying farmers' preferences for contract terms. Then, it shows the procedure for estimating the effect of the contract terms on side-selling. Finally, the approaches used in investigating farmers' views on side-selling and contract breach resolution mechanisms available to contracting parties are explained.

#### **5.3.1 Identification of contract terms in the vegetable value chain**

As shown earlier in the conceptual framework, a contract as a transaction coordination governance is necessary to mitigate the uncertainties and costs associated with spot market exchange but may have an implicit moral hazard such as side-selling. Hence, uncertainties of transaction that generates potential side-selling must shape the buyer's choice of contract terms if he aims to mitigate side-selling. This section describes the methods employed in identifying contract terms in the Ghanaian vegetable value chain. A list of possible contract terms obtained through interviews with experts, comprising the leadership of the VEPEAG and GAVEX, and through literature reviews on contract farming practices in developing countries, were presented to farmers who were asked to select those applicable to their current contract arrangements. Descriptive statistics were used to analyze the responses from farmers. The effects of the identified contract terms on side-selling were then estimated.

#### **5.3.2 Identification of farmers' preferences for contract terms**

While the last section described how existing contract terms in the value chain were identified, this section describes the procedure used to identify contract terms that are preferred by farmers but may not be specified in their existing contract. Presented with a list of possible contract terms, farmers were asked to indicate their preferences by rating them from '5', signifying the most preferred term to '1', indicating the least preferred term. Descriptive statistics were employed to analyze farmers' responses.

### **5.3.3 Analytical method for estimating the effect of contract terms on side-selling**

In the empirical literature, quantitative methods constitute the most common analytical techniques for analyzing the effects of attributes or characteristics of a good on decisions or choices. Three important classes of these analytical methods include the binary choice model, the multiple-choice model, and the censored model. The binary choice model includes the Logit model and the Probit model. Similarly, the multiple-choice model can be broken down into ordered multinomial Logit and Probit and unordered multinomial Logit and Probit. The censored model comprises the Tobit model. In the following, the Logit and the Probit models are discussed and their suitability to the present study determined.

#### **5.3.3.1 Binary choice models: Logit and Probit models**

The Probit and the Logit models are binary response modelling techniques used when the response variable takes on two values. They model the probability that observation with attributes falls in one of two categories. These models are frequently applied in socioeconomic studies to establish a relationship between a dichotomous response variable and a set of predictor variables. The Logit and Probit models perform a similar function and yield similar results. The main difference between these models, according to Amemiya (1983) is that in the Probit model the error term is assumed to be normally distributed, whereas in the Logit model the error term follows a Logistic distribution. Another difference between them is that the coefficients that are yielded by a Logit model are greater than those generated by the Probit model by a scalar of 1.60 (Amemiya, 1983).

The Logit and the Probit models have been applied in the empirical studies to estimate factors that influence choices or the likelihood of an occurrence of a phenomenon. For example, Haji (2010) examined factors that determine whether or not farmers will rely on brokers to mediate contractual disputes in traditional vegetable contracts in the Eastern and Central parts of Ethiopia using the Logit model. Supaporn *et al.* (2013) used the Logit model to estimate factors that determine whether farmers would use rice straw compost in Northeastern Thailand. Also, in identifying factors that are associated with attitudes of farmers in the safe use of pesticides among irrigated farmers in the Jimma Zone of

Southwest Ethiopia, Gesesew *et al.* (2016) used the Logit model. In determining the occurrence of a contract breach in the Brazilian tomato processing industry, Zylbersztajn and Nadalini (2007) used the Logit model. Osmani and Hossain (2015) employed a Probit model to analyse factors that influenced smallholder farmers' market participation decisions in Bangladesh.

According to Amemiya (1983), there is no theoretical basis for the choice between Logit and Probit models. The choice may depend on the researcher's preference and convenience. For example, according to Maddala (1986), the Logit model is computationally more convenient than the Probit model. The present study will apply the Logit model in the analysis of the effect of contract terms on farmers' decisions to engage in side-selling. Following Wooldridge (2010) the binary Logit model is generally specified as:

$$L_n(odd) = L_n\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \dots + \beta_m X_m + \mu \quad (1)$$

where  $P$  is the probability,  $\beta_0$  is the intercept,  $\beta_1 - \beta_m$  are the regression coefficients of the explanatory variables  $X_1 - X_m$  and  $\mu$  is the error term. The technique of maximum likelihood estimation is used to estimate the coefficients,  $\beta_1 \dots \beta_m$ , of the regression equation.

### 5.3.3.2 Empirical model specification

Following the theoretical model explained in section 3.3.2.1, the empirical model for estimating farmers' decision to side-sell is specified as:

$$SS = L_n\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 AGE + \beta_2 MALE + \beta_3 EDU + \beta_4 CP + \beta_5 DP + \beta_6 FM + \beta_7 SC \\ + \beta_8 DM + \beta_9 PM + RP + \beta_{10} FGD + u \quad (2)$$

where

$SS$  = probability of engaging in side-selling

$\beta_0$  = intercept

$\beta_1 - \beta_{10}$  = regression coefficients of the independent variables to be estimated.

### **5.3.3.3 Description of variables used in the empirical model**

The independent variables used in the empirical model refers to the contract terms that were identified in the vegetable chain contracts. It refers to the results of the investigation of the contract terms in the value chain as shown in Table 5.3 of section 5.4.4. The description of the variables, their measurement, and their expected effect on side-selling are as follows:

*Contract price (CP)* This variable refers to the time that the contract price is set. According to Eaton and Shepherd (2001), the buyer may set the contract price during contract initiation or at a stage in the production process. In this study, it is measured as the average number of days from the day the price was set to the day the farmer is required to deliver the product. The results of the investigation of the contract terms show that the contract price is set 5 days on average before the required date for the farmer to deliver the product, contrarily to the prediction of the hypothesis. Hence, a positive relationship is expected between this variable and side-selling.

*Delayed payment (DP):* Delayed payment refers to the length of days it takes for a farmer to receive payment after delivering the products to the buyer. This is measured as an average number of days from the day the product was sold to the day payment was received by the farmer. According to the conceptual framework, immediate cash payment is expected while a delayed payment leads to side-selling. From the results of the examination of the contract terms in the value chain shown in Table 5.3 of section 5.4.4, the contract involves a delayed payment of 10 days contrary to the hypothesis. Therefore, this variable is expected to have a positive relationship with side-selling.

*Farm monitoring (FM):* Farm monitoring refers to farm visits by the buyer. It is measured as the average number of days in a production season that the buyer visited the farm. The results of the investigation of the contract terms in Table 5.3 show that farm monitoring is 3 times per season. A negative relationship is expected between monitoring and side-selling.

*Farmgate delivery (FGD)*: Farmgate delivery is a contract term that specifies the location where the farmer must deliver the harvested product. The results of contract terms investigation in Table 5.3 show that some of the contracts specified farmgate delivery while others required the farmers to deliver the product to the buyers' location with the farmers' means of transport. This variable is measured as a dummy, where 1 implies that the contract involves delivery at the farmgate whereas 0 implies that the farmers must transport the product by their means to where the buyer is located. From the conceptual framework in chapter 4 farmgate delivery is expected to mitigate side-selling.

*Contracts switched (CS)*: This refers to the number of contract relationships the farmer has switched and implies the duration of a contractual relationship. It is measured as the average number of contract relationships the farmer has switched in the last five years. The more the number of contracts switched, the shorter the contract duration. From Table 5.3, the average number of contracts switched in the last five seasons is 3, indicating shorter contract relationship. According to the hypothesis, a shorter contract relationship will have a positive effect on side-selling.

*Distance to an alternative market (DM)*: This refers to the average distance from the contract farm to an alternative market where farmers have side-selling opportunities. This variable is measured as the distance, in kilometers, from the farm to the nearest alternative market. The variable, according to the results of the investigation of contract terms shown in Table 5.3 is 65km.

*Production management (PM)*: This variable refers to a production management contract and is measured as a dummy variable, where 1 refers to a production management contract and 0 refers to the base alternative, marketing contract. The conceptual framework predicts a negative relationship between a production management contract and side-selling.

*Resource provision (RP)*: This variable refers to a resource provision contract. It is measured as a dummy variable where 1 means the contract involves resource provision and

0 implies the base alternative, marketing contract. A negative relationship is expected between resource provision contracts and side-selling, according to the conceptual framework.

*Age of farmer (AGE):* This variable refers to how old the farmer is and it is measured in years. It is expected that older farmers will not engage in side-selling.

*Gender of the farmer (MALE):* This is a dummy variable, where 1 implies a male farmer, and 0 means a female farmer.

*Years of education of farmer (EDU):* This means a farmer's attainment of a higher level of education and measured as the number of years of formal education. A negative relationship is expected between education and side-selling.

#### **5.3.4 Methods for examining farmers' views on side-selling.**

Through discussions with the leadership of the VEPEAG and GAVEX, a series of opinions regarding side-selling were outlined. These expert opinions were presented to farmers in the form of five statements, and they were asked to indicate the extent of their agreement to those statements. The number "5" meant strongly agreed while "1" indicated least agreed. A statement with an average score of 3 and above is considered important. Descriptive statistics were used to analyze farmers' responses.

#### **5.3.5 Methods for identifying contract breach resolution mechanisms**

To identify procedures used by farmers and buying firms to address conflicts arising from contract breaches, both buyers and farmers were asked to enumerate how they resolved past breaches and how they intend to resolve future ones. Analysis of these responses with descriptive statistics provided an understanding of the enforcement strategies available to farmers and buying firms.

## **5.4 Results**

### **5.4.1 Introduction**

This section presents the results of the first part of the study, which was to investigate the contract terms in the vegetable value chain and how these terms drive or mitigate side-selling. It also presents results on farmers' preferences for contract terms and their views on side-selling. This part of the study is founded on the conceptual framework that, while contracts aim to cure uncertainties and cost of spot market transactions, contracts have implicit side-selling. To mitigate side-selling, the choice of the contract terms must be shaped by the uncertainties that potentially lead to side-selling. Section 5.4.2 presents the demographics and farm characteristics of the survey respondents, followed by the types of agronomic practices that are specified in the value chain contracts in section 5.4.3. The results of the investigation of contract terms used in the value chain are shown in section 5.4.4 whereas section 5.4.5 presents the results of farmers' preferences for contract terms. In section 5.4.6, the results of the effect of contract terms on side-selling are presented. The section concludes by presenting the results of farmers' views on side-selling and contract breach resolution methods in section 5.4.7 and 5.4.8 respectively.

### **5.4.2 Demographic and farm characteristics of respondents**

An overview of the farm and socio-demographic characteristics of the farmers included in the sample are presented in Table 5. 2. The mean age of farmers in the sample is 45.6 with the majority representing 82.9 percent being males. 37.1 percent of the sample have basic education with 30.4 and 23.3 percent holding secondary school certificate and tertiary degree, respectively. Farmers have a household size of about 3.9 and have engaged in farming as their major occupation for about 19 years. Vegetable farms have an average size of 1.6 acres, with pepper being the major vegetable grown, generating on average Gh¢ 6,000.00 (USD 1,518 at the time of the survey) in annual incomes for 13.8 percent of farmers. The following are noteworthy differences in the export and the traditional marketing channels. Farmers in the export marketing channel have bigger farm sizes, 1.87 acres, compared with 1.28 for farmers in the traditional marketing channel. Also, while 20 percent of farmers in the export marketing channel earn Gh¢ 6,000.00, only 7.5 percent earn this amount in the traditional marketing channel. In terms of education, 27.5 percent

of farmers in the traditional market has some forms of tertiary education whereas 19.1 percent in the export marketing channel does.

Table 5. 2: Demographic and farm characteristics of respondents

Characteristics	Export market	Traditional market	Both export and traditional market
Age	45	45.7	45.6
Male (%)	84.2	81.7	82.9
Educational attainment:			
<i>No education</i>	14.2	4.20	9.2
<i>Basic</i>	33.4	40.8	37.1
<i>Secondary</i>	33.3	27.5	30.4
<i>Tertiary</i>	19.1	27.5	23.3
Household size	4.14	3.58	3.86
Farm size	1.88	1.27	1.58
Farming as major occupation (%)	68.3	64.2	66.3
Major vegetable grown (%):			
<i>Garden eggs</i>	21.7	5.00	13.3
<i>Tomatoes</i>	0.00	25.8	12.9
<i>Pepper</i>	32.5	45.0	38.8
<i>Okro</i>	14.2	24.2	19.2
<i>Turia</i>	15.8	0.00	7.90
<i>Tinda</i>	5.80	0.00	2.90
<i>Gourd</i>	5.00	0.00	2.50
<i>Marrow</i>	5.00	0.00	2.50
Years of farming	19.6	18.4	19.0
Farm income (Ghc) %:			
<1,000	22.5	27.5	25.0
1,000 – 2,000	23.3	45.0	34.2
2,100 – 4,000	16.7	10.8	13.8
4, 100 – 6,000	17.5	9.20	13.3
> 6, 000	20.0	7.50	13.8

Source: survey data, 2016

### 5.4.3 Specification of vegetables agronomic practices

An important transaction characteristic that contract farming must address is the uncertainty about product quality. Contracts in the Ghanaian vegetable supply chain, in recent times, are faced with vegetable safety and quality issues. Anecdotal evidence attributes the



vegetable quality problems to firms' unwillingness to commit to the provision of production inputs and other important agronomic services to farmers due to fear of hold-up through side-selling. The following presents results on an investigation of firms' commitment to the specification of agronomic practices, known to enhance vegetable quality and safety. As shown in Figure 5.2, about 79% of contracts in the export market channel specified the type of seed that must be grown by the farmers while 78 % specified the type of agrochemical (fertilizers and pesticides) that must be applied on crops.

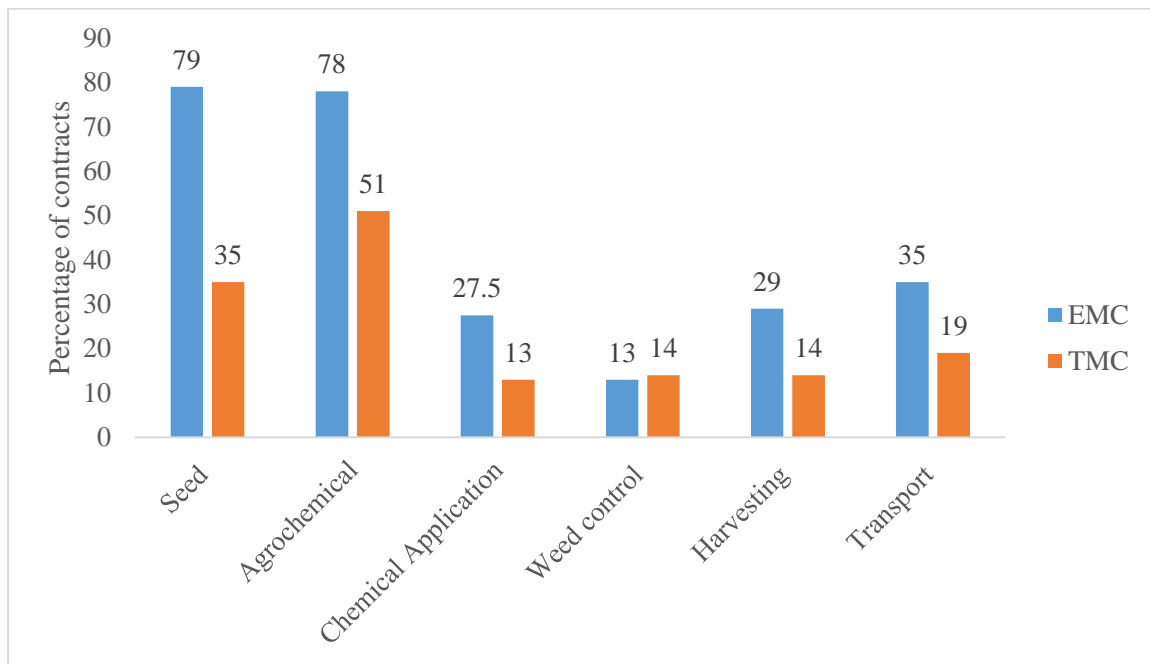


Figure 5. 2: Percentage of the contracts specifying agronomic practices

Despite several contracts specifying the type of agrochemical, only 27.5% demonstrated how and when agrochemicals should be applied to the crop. The results show that buying firms are less committed to prescribing weed control and harvesting regimes as well as the mode of transporting the product where applicable. In the traditional marketing channel, the results reveal that buying firms show lesser commitment to specifying agronomic practices compared to the export marketing channel. Only 35% of contracts have the types of seeds specified in the traditional marketing channel. Though 51% of contracts specify the type of agrochemicals, only 13 % involve the demonstration of agrochemical applications. Similarly, weed control regimes, harvesting procedures, and modes of

transporting harvested products are not spelled out in most contracts in the traditional marketing channel.

#### 5.4.4 Contract terms used in the vegetable supply chain

This section describes contract terms that were observed in the Ghanaian vegetable value chain. As shown in Table 5.3, contracts predominantly involve informal verbal agreements, confirming the prediction of the hypothesis.

Table 5. 3: Contract terms used in the vegetable value chain and how terms differ in the export marketing channel (EMC) and the traditional marketing channel (TMC)

Contract Attributes	Entire Market (std. dev)	EMC Mean (std. dev)	TMC Mean (std. dev)	EMC - TMC	t-value
Time of contract price setting	4.6 (2.7)	4.7 (2.8)	4.4 (2.5)	0.27	0.76
Delayed payment	9.6 (8.1)	8.3 (7.6)	10.9 (8.5)	-2.58***	-2.46
Distance to alternative market	65.2 (53.8)	75.1(54.1)	55.3 (52.0)	19.85***	2.90
Monitoring	3.3 (1.3)	3.4 (1.4)	3.1 (1.3)	0.33**	1.92
Switch contract	3.37	3.36 (1.2)	3.38 (1.6)	-0.02	-0.09
Verbal/Informal (%)	95.4	92.5 (0.26)	98.3 (0.12)	0.05	2.17
FBO membership (%)	58.3	84.2 (0.37)	32.5 (0.47)	-0.52***	-9.41
Buyer and farmer from same community (%)	32.1	34.2 (0.47)	30.8 (0.46)	-0.03	-0.41
Farm gate delivery (%)	53.3	70.8 (0.46)	35.8 (0.48)	-0.36***	-5.93
Production management (%)	32.5	36.7 (0.49)	28.3 (0.48)	0.02	0.27
Resource provision (%)	19.6	20.0 (0.49)	19.2 (0.50)	-0.09	-1.42
Marketing Contract (%)	47.9	43.3 (0.48)	52.5 (0.39)	0.03	0.59

\*\*\* t < 0.01: \*\* t < 0.05: \* t < 0.1

Due to the importance of the buyer's involvement in on-farm production activities to reduce the information asymmetry on farm output, the conceptual framework predicted the use of a production management contract. But the results show that contracts mostly involve simple marketing arrangements. This is a contradiction of the hypothesis. In terms of contract price arrangement, the results show that contracts involve variable pricing, and the price is set 5 days before the required date for the farmer to deliver the product. This price

arrangement is not consistent with the predictions of the hypothesis. According to the hypothesis, the contract will use split pricing, involving a fixed and variable price component. The results reveal that farmers receive payment in 10 days after they have delivered the product. This also contradicts the predictions of the conceptual framework, which states that farmers will receive immediate payment, at the point of sale, considering the frequent price fluctuations that characterize transactions.

The results show that farms are located about 65 km away from alternative markets and buyers monitor farms 3 times in a season on average. Though there is not a benchmark in terms of a required distance between contract farms and alternative markets, 6k km is considered long enough to confirm the hypothesis that contract farms must be located far away from alternative markets to reduce side-selling opportunities. About 53.3 percent of contracts involve an agreement for the buyer to take delivery of the product at the farm gate. This supports the hypothesis that contracts will specify farm-gate delivery. According to the hypothesis, contracts will involve farmers and buyers who come from the same community, to facilitate contract enforcement through the inducement of reputational concern. The results, however, show that only 32.1% of contracts involve the buyer and the farmer coming from the same community and, therefore, contradict the hypothesis. The results reveal that 58.3% of contracts involve farmers associated with farmer-based producers or marketing organizations, confirming the hypothesis. Farmers switched from one buyer to another 3 times in 5 seasons, implying a shorter contract relation between the buyer and the farmers. According to the hypothesis, contracts must involve longer duration so that the repeated interaction between parties would provide contract enforcement, in the absence of third-party enforcement. Thus, the result does not support the hypothesis.

A t-test compared whether there are significant differences in the terms of the contracts in the export and the traditional marketing channels. Contract terms such as marketing contracts, informal verbal contracts, contract price which is set 5 days before the required date for product delivery, shorter contract duration, and fewer farmers and buyers coming from the same community do not differ between the two marketing channels. The following terms, however, differ between the two marketing channels. First, the time of payment for

products delivered is 8 days on average in the traditional marketing channel but 11 days in the export marketing channel. Regardless of the difference, the term in either of the marketing channels does not support the hypothesis. Also, farmers in the export marketing channel have their farms located significantly further away, about 75.1 km, from alternative markets compared to 55.3 km away, in the traditional marketing channel. The term in the export market channel is long enough to confirm the hypothesis but not in the traditional marketing channel. Farmers in the export marketing channel are predominantly drawn from farmer-based organizations, with contract agreement comprising mostly farm-gate delivery of products. The reverse is true in the traditional marketing channel. Implying the term in the export marketing channel is consistent with the hypothesis but not supported in the traditional marketing channel. 70.8% of contracts in the export marketing channel involves farm-gate delivery, confirming the hypothesis, while 35.8% of contracts in the traditional marketing channel specified farm-gate delivery, contradicting the hypothesis.

#### **5.4.5 Farmers' preferences for contract terms and how preferences differ in the export and traditional marketing channels**

Section 5.4.4 presented a description of the contract terms used in the Ghanaian vegetable value chain. The contract farming literature has observed that firms usually impose biased contract terms on farmers and ignore farmers' preferences for contract terms. Biased contract terms, according to Abebe *et al.* (2013) and Fischer and Wollni (2018) possibly account for contract instability, and suggest that farmers' contract preferences may have to be incorporated in contract design to enhance compliance and coordination. This section thus presents results on farmers' preferences for contract terms and suggests how contract farming arrangement may incorporate farmers' preferences. As shown in Table 5.4, on a scale of 1 to 5, where 5 means most preferred, farmers on average rated payment received immediately at the point of sale as 4.98, court-enforced contract as 4.92, resource provision contract as 4.81, and fixed-price contract as 4.67. These imply that farmers have a higher preference for a resource provision contract with a fixed price arrangement and immediate payment at the point of sale, and which can be enforced formally at the court. Next, a long-term contract, a contract that specifies product grades with premium pay for higher quality and production management contracts are preferred with ratings of 3.76, 3.70, and 3.56, respectively. Farmers have a moderate preference for a contract specifying farm-gate

delivery of products with a rating of 2.75. Farmers indicated less preference for contracts based on specifications of quantities with a rating of 2.42, area (acreage) with a rating of 2.13, variable price with a rating of 1.63, and market specification with a rating of 1.02. Focusing on the preferred contract terms, a comparison of the export marketing channel and the traditional marketing channel shows that grading of products and premium pay for higher quality and farm-gate delivery are most preferred in the export marketing channel whereas immediate payment at the point of sale, court-enforced contract, resource provision, and production management contracts are preferred in the traditional marketing channel. Preferences for a fixed price and long-term contracts do not differ between the two marketing channels.

Table 5. 4: Farmer preferences for contract terms and how preferences differ in the export marketing channel (EMC) and the traditional marketing channel (TMC)

Contract terms	Entire market Mean (std dev)	EMC Mean (std dev)	TMC Mean (std dev)	Mean Difference (EMC-TMC)	t-value
Payment received on delivery	4.98 (0.15)	4.96 (0.20)	4.99 (0.09)	-0.03*	-1.66
Fixed price contract	4.67 (1.08)	4.67 (1.07)	4.67 (1.11)	0	0.00
Variable contract price	1.63 (1.45)	1.89 (1.66)	1.37 (1.16)	0.52***	2.84
Farm gate delivery	2.75 (1.03)	2.98 (1.07)	2.53 (0.94)	0.44***	3.39
Grading and premium pay for higher quality product	3.70 (0.97)	3.83 (1.05)	3.58 (0.88)	0.24*	1.93
Court enforced contract	4.92 (0.35)	4.85 (0.47)	4.98 (0.12)	-0.13***	-2.79
Non-binding contract	1.02 (0.16)	1.03 (0.22)	1.00 (0)	0.03*	1.64
Long term contract	3.76 (1.22)	3.80 (1.20)	3.73 (1.24)	0.08	0.48
Contracting on quantity quotas	2.42 (0.75)	2.53 (0.83)	2.31 (0.65)	0.21**	2.17
Contracting on area (acreage)	2.13 (0.82)	1.99 (0.84)	2.28 (0.79)	-0.28***	-2.70
Resource providing	4.81 (0.42)	4.73 (0.50)	4.89 (0.31)	-0.17***	-3.09
Production management	3.56 (0.88)	3.27 (0.91)	3.88 (0.74)	-0.61***	-5.79
Marketing contract	1.02 (0.14)	1.04 (0.20)	1.00 (0)	0.04**	2.27

\*\*\* t < 0.01; \*\* t < 0.05; \* t < 0.1

#### 5.4.6 The effects of contract terms on side-selling

This section presents the results of the second objective of the study which aims to ascertain how the contract terms used in the vegetable supply chain affect side-selling. From the

conceptual framework, a contract aims to reduce uncertainties associated with spot market transactions. Contracts, however, have implicit moral hazard such as side-selling, and to mitigate them, the choice of the terms of the contract matter. The first objective of the thesis was to identify these contract terms, the results of which have been shown in section 5.4.4. Logistic regression was then used to estimate the effect of the identified contract terms, as independent variables, on farmers' decision to side-sell, as a dichotomous dependent variable. The results displayed in Table 5.5 show that all variables except farm-gate delivery, resource provision contract, education, and gender of the farmers have a significant effect on side-selling and have the expected signs.

Table 5. 5: Logit estimates of the effects of contract terms on side-selling

Variable	Coefficient	Standard error	Odd ratio
Time of contract price setting	0.467**	0.254	1.596
Delayed payment	0.262***	0.107	1.300
Shorter contract duration	1.065***	0.107	2.903
Farmgate delivery	0.185	1.278	0.885
Production management contract	-2.857**	1.257	0.057
Resource providing contract	1.412	1.292	0.057
Monitoring	-1.336**	0.448	0.057
Distance to alternative market	-0.187**	0.010	0.981
Age	-0.159***	0.048	0.856
Gender	1.571	1.308	4.816
Education	0.025	0.124	1.025
Constant	4.884	3.264	132.2

\*\*\* P < 0.01; \*\* P < 0.05; \* P < 0.1

Prob > chi<sup>2</sup> 0.000

Pseudo chi<sup>2</sup> 0.890

Log Likelihood -18.13

Observation 240

The contract price, which was found to be variable and set 5 days before the date required for the farmer to deliver the product, increases the likelihood of side-selling. This variable,

as shown in section 5.4.4 contradicts the hypothesis of the conceptual framework. From the results, the likelihood that a farmer will indulge in side-selling increases by 59% for each extra day from the day the price is agreed to the required date for product delivery. Similarly, delayed payment, which was observed to be 10 days after product delivery and contradicts the hypothesis, leads to side-selling. The likelihood of side-selling increases by 30% for each day delay in payment. It was found that farmers switched from one buying firm to the other, 3 times in 5 seasons on average. This signifies shorter contract duration (relationship) and does not support the prediction of the conceptual framework. Shorter contract relationship increases the likelihood of side-selling by 90%. On the other hand, farm monitoring, which was found to be 3 times per season reduces the likelihood of side-selling. For every one-time monitoring, the likelihood of side-selling decreases by 94%. The results show that a contract involving production management reduces side-selling. The likelihood of side-selling is decreased by 94% in a production management contract compared to the baseline, market specification contract. Also, the distance between farm location and alternative market for side-selling, which was found to be 65km, decreases the likelihood of side-selling. The likelihood of side-selling decreases by 1.9% for each kilometer increase in the distance between farm location and the alternative market.

#### **5.4.7 Major contractual breaches and resolution mechanisms in the Ghanaian vegetable value chain**

This section presents results on an examination of aspects of contract agreements that are frequently breached by both contracting partners, and available strategies for resolution of breaches when they occur. Anecdotal evidence from key informant interviews before the survey and from the literature on contract farming suggested that contract breaches in the agri-food chain take many forms, and both the firm and the farmer indulge in it. Moreover, anecdotal evidence suggests that contract breaches are possibly a strategic reaction to anticipated breaches from the other party. To prescribe possible mitigation measures, which is the focus of the second part of the thesis, it is important to first understand the nature of breaches and how parties attempt to resolve it.

### 5.4.7.1 Major contract breaches in the vegetable supply chain

The following contract breaches by buying firms, as shown in Figure 5.3, were identified in the value chain; Failure to show up at harvest to purchase the contracted product, payment reduction at the point of sale, defaulted payment, and renegeing on input provision agreement.

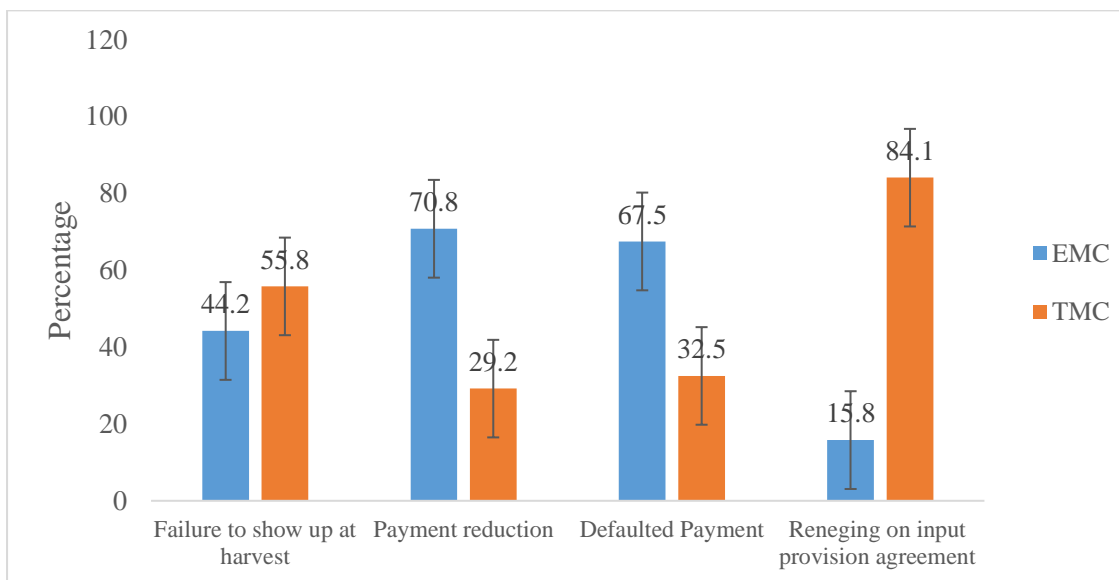


Figure 5. 3: Major contract breaches by buyers

Contract breaches in the export marketing channel involve payment reductions and defaulted payments, which were observed in 70.8% and 67.5% of contracts, respectively. Payment reductions and defaulted payments were, however, less common in the traditional marketing channel, occurring in 29.2% and 32.5% of contracts, respectively. Payment reduction refers to a reduction of the promised contract price and occurs when the farmer has already delivered the commodity. Defaulted payment, however, refers to non-payment for the product procured. Reneging on input provision agreement, which applies to resource provision contract is the major contract breach, occurring in 84.1% of contracts in the traditional marketing channel, but the least observed breach in the export marketing channel, occurring in only 15.8% of contracts. Reneging on inputs provision agreement means that the buyer shirks on an earlier promise, made during the contract initiation, to support farmers with production inputs. The buyer's failure to show up to purchase contracted commodity occurs in 44.2% and 55.8% of contracts in the export and the traditional marketing channels, respectively.



As shown in Figure 5.4, contract breaches by farmers include missing harvesting schedule, which occurs in 46.7 % and 53.3 percent of contracts in the export and the traditional marketing channels, respectively. Side-selling, which is the subject of investigation of the thesis was observed in 52.5% of contracts in the export marketing channel and 47.5% of contracts in the traditional marketing channel. Farmers’ failure to meet product quality specifications occurs in 57.5% and 42.5% of contracts in the traditional and the export marketing channels, respectively.

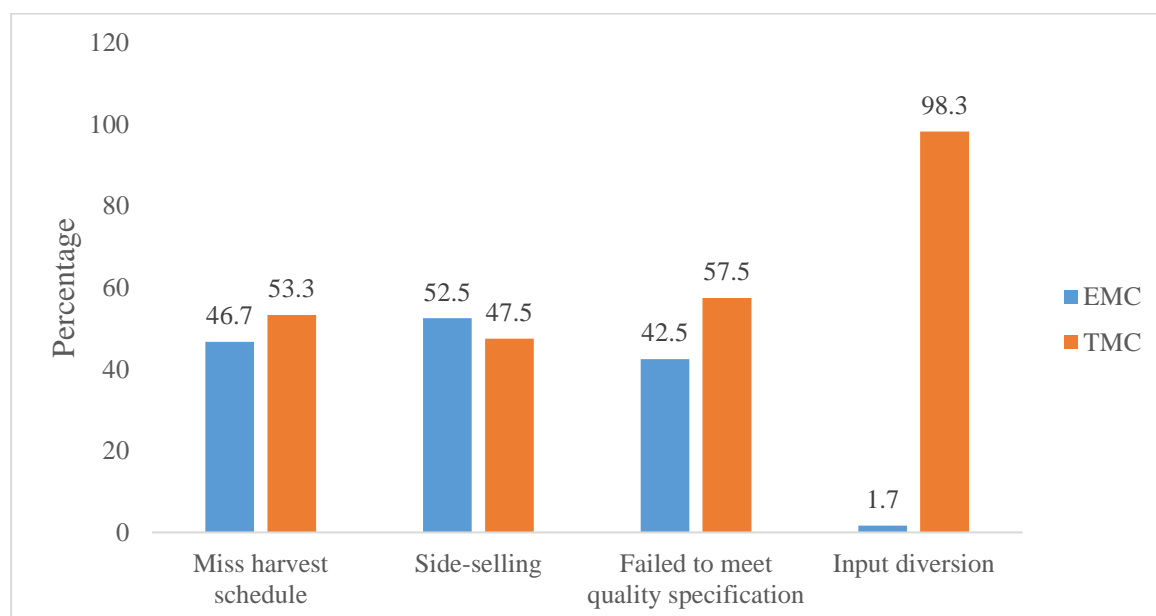


Figure 5. 4: Contract breaches by farmers

#### 5.4.7.2 Contract breach resolution methods

This section presents results on an examination of methods used by buyers and farmers to resolve contract breaches described in the last section. The results shown in Table 5.6 indicates that 7.5% of farmers in the export marketing channel and 2.5% in the traditional marketing channel fall on opinion leaders<sup>2</sup> to seek resolution when buyers breach the contract. About 30.8% of farmers in the export marketing channel and 25% in the

<sup>2</sup> In Ghana, opinion leaders are persons with local authority and informal or formal power to enforce conflict resolution between opposing parties in transactions. They are often community leaders or village chiefs in rural farming areas.

traditional marketing channel rely on contract termination, meaning they cease to have contractual relationships with the buyer if the buyer breaches the contract, as means of resolving future breaches. A major response by farmers against contract breach, which can best be described as a reaction other than a resolution method, is that they do not trust buyers in subsequent contract relationships if previous contracts were breached. This was observed in 56.7% and 70.8% of contracts in the export and the traditional marketing channels, respectively. Buyers also use contract termination as a means of resolving breaches. In the export marketing channel, 9 out of the 10 buyers interviewed indicated that they relied on contract termination while 33 out of the 40 buyers interviewed in the traditional marketing channel used contract termination to resolve breaches.

Table 5. 6: Actions taken to resolve contract breaches

	EMC	TMC
<i>Action taken by farmers</i>	<i>% of farmers</i>	<i>% of farmer</i>
Report to opinion leaders	7.5	2.5
Terminate contract with buyers	30.8	25
Fail to trust buyers in a subsequent trade	56.7	70.8
Never breached	5	1.7
 <i>Action taken by Buyers</i>	 <i>No. of buyers</i>	 <i>No. of buyer</i>
Terminate contract with the farmer	9	33
Resolve breach through opinion leaders	1	7

*Source: Survey data, 2016*

#### **5.4.8 Farmers' views on side-selling**

Side-selling is behavioural and can be influenced by how farmers consider or regard the practice. Their views about side-selling, therefore, is important to deepen an understanding of the underlying causes of the behaviour and, further, provides insight into possible strategies to mitigate them. This section presents the results of an investigation of how farmers view side-selling. On a scale of 1 to 5, where 5 means highly agreed, farmers indicated their views on statements related to side-selling. As shown in Figure 5.5, the views that most farmers engage in side-selling, and that the practice potentially contributes to the failure of agribusiness ventures, are commonly held among farmers. The view that incentives for side-selling are higher in contracts involving larger, resourceful firms and

government organizations are, however, not common among farmers. A noteworthy observation is that farmers do not consider side-selling as unacceptable behaviour.

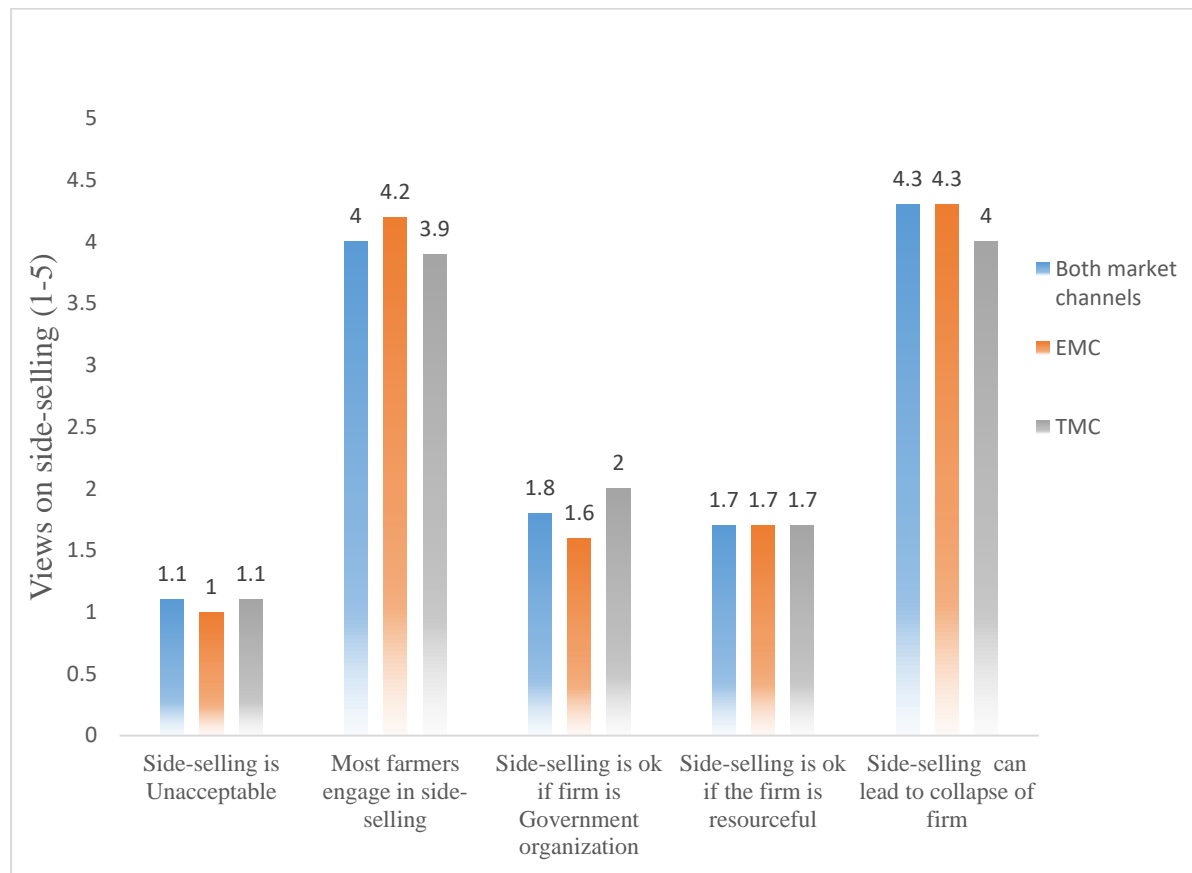


Figure 5.5: Farmers' views on side-selling

## 5.5 Discussion of the results

The conceptual framework described in chapter four, and on which the first part of the study is based, asserts that contracts have implicit side-selling and that their mitigation can depend on the choice of the terms of the contract. The first aim of the thesis, therefore, was to investigate contract terms that are being used in the Ghanaian vegetable value chain, and farmers' preferences for contract terms. The second examined how these contract terms mitigate or drive side-selling. The third aim was to examine farmers' views on side-selling. This section discusses the results. First, results on contract terms used in the value chain are discussed, showing differences and similarities in the export and the traditional marketing channels, followed by farmers' preferences for contract terms. Next, discussions of regression results on the effect of contract terms on side-selling are presented. Finally,

the section concludes with a discussion of contract breach resolution measures, followed by farmers' views on side-selling.

### **5.5.1 Contract terms in the vegetable value chain**

The results have shown that contracts in the Ghanaian vegetable value chain are governed by the following terms. Market specification and informal verbal contracts are the main types and forms of contract agreement, respectively. The terms of the contract include delayed payment, variable contract price which is set 5 days before the required date for product delivery, shorter contract duration (frequent switching of contract), farm gate delivery of the product, and 3 times farm monitoring per production season. Also, contracts engage farmers who are associated with farmer-based groups. Parties in contract farming are usually not from the same community and contract farms are located 65km away from an alternative market that offers an opportunity for side-selling.

The predominant use of market specification and informal verbal contracts confirm the observation made by Barrett *et al.* (2012) in their survey of the pineapple value chain in Ghana. They noted that firms prefer to have informal verbal contracts, partly because the arrangement allows them to retain flexibility in the contract, including the opportunity to renege on contracts as and when they want. Also, Fafchamps and Minten (2001) have observed that when a firm has a pre-existing relationship with suppliers, and wish to rely on contract termination as an enforcement tool, or when it is costly to enforce a contract legally, they tend to use verbal agreements. In Ghana, the difficulty of enforcing contracts legally is obvious even in the formal sector. It takes a long time and repeated adjournments for court cases to be finally prosecuted and justice served. The financial burden and time involved in repeated visits to court is a great disincentive for seeking resolution of conflicts in courts. This may justify the use of informal verbal contracts because parties may not be able to enforce written contracts in the court anyway. These results conform to the observations made by Bogetoft and Olesen (2002), in their study of ten rules of thumb in contract design, and Fafchamps (2004), in his investigation of market institutions in Sub-Saharan African countries. Delayed payment, which involves an average waiting time of 10 days for the farmer to receive payment after delivering the contracted product may be

inconvenient to farmers, especially the smallholder resource-poor farmers. Delayed payment, however, is not peculiar to the Ghanaian vegetable value chain. For example, Little (2000) observed a similar phenomenon in the pineapple sector in Ghana involving payment to farmers after pineapples had been exported. Little showed that only about 13% of farmers received payment at the point of sale. Similarly, Romero Granja and Wollni (2019) observed that broccoli farmers in Ecuador received payment for their produce within 2 weeks of the delivery of the contracted broccoli. The time it takes to receive payment, however, should not be a major problem if both parties have earlier reached an agreement on the date.

The use of a variable contract price in the vegetable value chain supports the argument of Eaton and Shepherd (2001) who noted in their contract farming theory and practice that for seasonal crops whose price often fluctuates, the use of variable contract price based on the spot market price is advisable. This is supported by Lyon (2000) who argued that frequent fluctuations in market prices make fixed pricing arrangements complicated for both buyers and farmers. Also, it conforms to price determination arrangements and timelines observed by Little (2000) in pineapple contracts in Ghana. The type of variable price arrangement observed in this study, however, differs from the observed in the literature. From the results, the contract price is agreed 5 days earlier before the required date for product delivery and it is based on the spot market price. Due to price volatilities, the agreed price and the spot market price may vary by the time product delivery is due unless the contract contained a provision to update price to reflect the current spot market price. The possible reason to agree on price earlier than the day of delivery is to secure from farmers the assurance of delivery. Such affirmation of contract or commitment to deliver is important considering the rampant incidence of failure to honour contracts by either party.

Another important contract term observed in the value chain is the switching from one contract to another, an indication of a shorter contract duration (shorter buyer-seller relationship). This contract term differs from the recommendations of contract farming practices, which argues that for self-enforcement, there must be a continued relationship between parties in an informal agricultural contract. According to Bijman (2008b),

agricultural contracts are offered on a seasonal basis but are automatically renewed, except for non-performers or due to breaches. Three major reasons explained in a contract farming conceptual framework by Barrett *et al.* (2012) possibly account for the shorter contract duration observed in the value chain. First, it could be a result of a non-renewal of contracts for dishonest farmers. Second, firms may pull out of contracts or drop farmers from the contract if demand in their retail market is uncertain, dwindles, or if they find a better alternative supply source. Third, farmers may withdraw from a contract if gains from the contract fall short of expected utility. This study is not able to establish if the short-term nature of contracts is due to termination for non-performance or breaches. Considering the high incidence of breaches observed in the study, however, it may be justified to relate the short-term contract relationship to breaches and contract termination.

Contract terms also include contract offers to farmers associated with Farmer-Based Organization (FBO), farm gate delivery of the product, and farm monitoring. These terms are more commonly observed in the export marketing channel compared to the traditional marketing channel. Most farmers in the value chain are smallholders. To reduce transaction costs and yet be able to have access to many farmers and bulk commodity supplies, contracting with farmer groups such as FBOs becomes useful. Also, FBOs tend to be the most reliable suppliers in contracts because of the inherent prospective group enforcement they offer. According to Barrett *et al.* (2012), contracting with FBOs offers the possibility of tapping into social networks relevant to the performance of the contract. The low usage of FBOs in the traditional marketing channel is not surprising. FBOs can cut the other way as they increase the bargaining power of farmers. Therefore, for the traditional marketing channel replete with smaller buying firms, contracting with FBOs may not be attractive as buyers may not be able to wield contractual bargaining power over farmers. Buying firms tend to extract most of the gains from trading relationships if they control most of the bargaining power (White, 1997; Sivramkrishna and Jyotishi, 2008).

A fewer number of contracts involved the buyer and the farmer coming from the same community. This term is an indication of social connection, with an inherent reputational effect capable of inducing contract compliance. Also, the use of opinion leaders such as

community leaders and traditional rulers in resolving conflicts, which is a respectable conflict resolution mechanism in Ghana, is easily executed at the community level, especially when affected parties are subjects of the opinion leader. For example, Barrett *et al.* (2012) found that smallholder pineapple growers usually participate in a contract with a neighboring buying firm. By contrast, this study observed that most of the buyers are in Accra, where the highest concentration of vegetable retail outlets exists and procure vegetables from farmers in surrounding farming communities.

In terms of distance from farm to an alternative market, the study observed that farms in the export marketing channel were located farther from alternative markets compared with farms in the traditional marketing channel. Generally, 65km (less than an hour drive at 80km per hour) may be considered proximal, but factors such as the nature of farm roads and access to farm trucks are important considerations. In Ghana, the generally deplorable state of farm roads and the lack of farmers' easy access to farm trucks, may mean the distance is long enough. Though buying firms prioritize procurement locations closer to urban areas and bigger markets, evidence from Barrett *et al.* (2012) suggests that in some cases firms prefer remote locations.

### **5.5.2 Preferences for contract terms**

The existing contract farming literature observes that buyers often dictate contract terms, leading to a selection of biased terms that potentially contribute to contract instability. The last section discussed the results of contract terms used in the vegetable value chain. The following discusses farmers' preferences for contract terms.

Immediate payment for the product at the point of delivery, court-enforced contract, resource provision contract, production management contract, grading of product and premium payment for higher quality, farm gate delivery of the product, fixed contract price, and long term contracts are preferred by farmers. Similarly, in an investigation of preferences for contract attributes in the potato supply chain in Ethiopia, Abebe *et al.*

(2013) observed that attributes such as written contracts, resource provision, and variable quality (grading of product) are preferred by smallholder Ethiopian potato farmers.

A comparison of farmers' preferences for contract terms in section 5.4.5 and the contracted terms being employed by buying firms in the value chain as shown in section 5.4.4 indicates that among the preferred contract terms by the farmers only farm-gate delivery is implemented in the Ghanaian vegetable value chain contracts. This shows that farmers' preferences are not adequately considered by buyers in designing the contract. This has potential implications for farmers' compliance with the contract. For example, as argued by Abebe *et al.* (2013) and Fischer and Wollni (2018) a disregard for farmers' preferences in contract design may lead to breaches.

A comparison of preferences in the export and the traditional marketing channels reveals similarities and differences in preferences between the two marketing channels. Fixed contract price and long-term contracts are preferred in both marketing channels, indicating similarities in preferences. In the export marketing channel, however, farmers prefer grading of produce and premium payment for higher quality and farm-gate delivery of the product. The export marketing channel emphasizes quality products, and to deliver it may require extra investment from farmers. The findings, therefore, suggest farmers want to receive a premium payment for their effort in delivering quality. It is fair that farmers are rewarded for extra effort and resources expended in producing higher quality output than would be demanded in the domestic traditional market. In other jurisdictions, higher quality product attracts higher prices (Eaton and Shepherd, 2001). Preference for a premium price for a higher quality product, therefore, conforms to established practices in the agricultural value chain. Arguing from the firm's perspective, grading and premium price for higher quality not only encourages farmers to deliver higher quality but also differentiates the export marketing channel from the traditional marketing channel and could potentially limit side-selling opportunities. This is because the traditional marketing channel does not emphasize quality and may, therefore, not pay a premium for higher quality. A case for a differentiated market has been argued by Berdegué (2002) and Hellin *et al.* (2009), that in a market for undifferentiated goods, coordination through contract is problematic since the



spot market will always offer an option for side-selling. A study by Maertens and Velde (2017) in Benin has shown that even for traditional staples where the market is undifferentiated, price premiums can overcome the constraint of side-selling.

Farm-gate delivery is essential given the role that packaging and transportation play in ensuring quality commodities in the export market channel. Therefore, farmers' preferences for farm-gate delivery support efforts in delivering quality products. Besides, farmers' access to transport to enable them to deliver the product on schedule may not be readily feasible and, therefore, suggests the importance of farm-gate delivery. Immediate payment for the product at the point of sale, court-enforced contracts, resource provision contracts, and production management contracts are preferred by farmers in the traditional marketing channel. The preferences for resource provision and production management contracts in the traditional marketing channel is suggestive of farmers' limitation in terms of resource availability and accessibility for production. The economic plight and resource limitation of many smallholder farmers explain their preferences for immediate payment for the delivered product. Smallholder resource-poor farmers cannot afford to wait too long to receive payment since they have limited resources to cushion themselves. Contrarily, in the export market, farmers may be relatively resourceful, as the descriptive statistics of farm sizes in Table 1 suggest, and can afford the required resources for production, or can wait for few more days to receive payment.

Farmers' preferences for court-enforced contracts may have originated from possible contract breaches by buyers. The results of the survey have pointed to incidences of breaches by buyers, including non-payment for the purchased product and failure to show up to purchase the contracted product, resulting in contract instability (Barrett *et al.*, 2012; Wuepper and Sauer, 2016). Farmers are much impacted financially if buyers breach payment agreements, or if buyers neglect to return to buy a contracted product. Court enforced contracts, therefore, if feasible can be advantageous to farmers. The likelihood of successful court enforcement of a contract by a farmer, against a more powerful and resourceful buyer, may, however, be minimal, and the cost involved in legal battles relative to prospective recovered damages may be too high to justify a legal suit (Narayanan, 2010).

Court enforced contracts could be effective through farmer groups as was shown by Barrett *et al.* (2012) in their examination of contract farming in developing countries. As farmer groups, they can pool resources, akin to cooperatives, to implement collective action, including legal enforcement of a contract. Thus, though the literature argues that court-enforced contracts may be expensive to implement by smallholder farmers, enforcement through farmer groups can be less costly and efficient.

### **5.5.3 The effect of contract terms on side-selling**

The regression results examined the effect of the contract terms used in the vegetable value chain on side-selling. From the results the following contract terms affect side-selling: variable contract price which is set 5 days before the required date for the farmer to deliver the contracted product, switching of contract (shorter contract duration), monitoring of farms, production management contract, and distance from contract farm to an alternative market. The results show that the time of setting the contract price, (i.e 5 days before delivery date) increases the likelihood of side-selling, and the following are the possible reasons. Incentives for side-selling in the West African food markets include higher spot market prices compared with the contract price. As noted by Lyon (2000) in his investigation of the fresh tomato market in Ghana, there is a frequent fluctuation of the spot market price in the vegetable chain. Even though in this study contract price is shown to be based on spot market price, within the time lag between concluding the contract price and delivering the product, the spot market price could exceed the contract price. The extent of volatility in vegetable prices in Ghana is such that there could be different price offers by different buyers in the same locality. Unless parties agree to update price to reflect potential changes, which should be the case under a variable pricing arrangement, farmers may have incentives to side-sell when the current spot market price is higher. According to a discussion held with farmers, buyers may agree to review the price to match the prevailing spot market price on the day of delivering the product if the farmers could prove the upward price change. However, there is often conflict about the real market price because of variations in sources and access to price information, as observed by Lyon (1999). In many cases when a buyer had agreed to adjust the earlier price to reflect the current market price, they fail to do so after the farmer has delivered the product.

The reason for side-selling due to delayed payment is that the farmers' main source of livelihood is dependent on vegetable production. Most of these farmers are resource-poor smallholders who cannot afford to wait too long before payment. Switching contracts often suggests a shorter contract relationship and the reason for its positive effect on side-selling includes the following. A possible enforcement approach recognized in an informal verbal contract is the repeated relationship which allows for the building of trust and imposition of sanctions on defaulting parties (Baker *et al.*, 2002; Fafchamps, 2004). In a shorter contract relationship, the likelihood of parties trading in the future is limited. Hence farmers can behave opportunistically by side-selling, knowing that they have no future relationship to protect. The next important contract terms that affect side-selling is farm monitoring. Monitoring reduces side-selling, contradicting the findings of (Kunte *et al.*, 2016) in his experimental investigation of informal enforcement in contract farming. Two reasons can be deduced from this observation. The first is that farm monitoring serves as a policing mechanism, ensuring that farmers do not divert products out of the contract. Second, there is an incentive not to side-sell if the relationship involves face-to-face meetings and regular communication, where conflicts relating to transactions could be addressed. Nooteboom (2002) in his study of the role of trust in an economy observed that face to meeting and communication helps to foster understanding, trust, and empathy between contracting parties. The following are the possible explanations for why production management contracts reduce the likelihood of side-selling. Monitoring, which has proved to reduce side-selling is an inherent feature of production management contracts. Often the peculiar characteristics, and for that matter, the agronomic requirement of crops grown under production management necessitates on-farm demonstrations and extension support by the buying firm. Hence there is frequent contact between the buyer and the farmers, limiting the farmers' chance to engage in side-selling. Second, many crops grown under production management contracts in Ghana are exotic varieties for which the demand in an alternative marketing channels is low. The longer distance from contract farms to alternative market observed in the value chain reduces the likelihood of side-selling because farmers will find it difficult to smuggle the product to other markets.

#### **5.5.4 Farmers' view on side-selling**

Farmers in the survey strongly consider side-selling as not unacceptable behaviour and believe that most farmers do engage in side-selling. Nonetheless, they, hold the view that side-selling has the potential to cause an agribusiness firm to fail. A synthesis of these views leads to the following insights. First, if farmers believe side-selling can lead to the failure of an agribusiness firm, then the view farmers hold that side-selling is not unacceptable behaviour is counterintuitive. A possible reason for farmers to not recognize side-selling as unacceptable behaviour is a denial of any feeling of guilt for engaging in the practice. Moreover, the response is suggestive of farmers' lack of readiness to abandon the practice. A possible reason for a person to not admit misconduct against another includes when the conduct is considered a reaction to the other's action. The empirical literature examining contract farming in developing countries is replete with instances of buying firms' penchant for breaching contracts, including abandoning harvested commodity (Barrett *et al.*, 2012), non-payment for the purchased product, and late payment (Fischer and Wollni, 2018; Romero Granja and Wollni, 2019). Contract breach by buyers put farmers in an awkward situation of having to search for other buyers or contend with losses from an unsellable commodity. Such a phenomenon could naturally solicit a reaction from farmers, shaping their perspective on the relationship. For example, Wuepper and Sauer (2016) observed pineapple contract performance in Ghana and noted that contract breaches from buying firms have changed the perception of farmers on contract farming. Farmers no longer trust promises made by farmers and do not recognize contracts as binding due to earlier failed promises. Another reason may be the generally perceived apathy among farmers in the rural economy of Ghana towards repayment of assistance schemes (small loans, input credit, etc.) received through Government projects and initiatives, partly due to widespread perception of corruption and neglect of the people by governments and government officials. Daum and Birner (2017) in providing insight on the neglected governance challenges of agricultural mechanization in Ghana observed that Ghanaian Governments and politicians have the inclinations to give out loans and inputs credit to farmers as "giveaways", that is, without a real intention that loan will be recovered, and even when the repayment intention is established, the government does not enforce it. These phenomena have generated a free-riding attitude among farmers. The attitude is likely to have found its way into relationships involving private firms. A related point, which has a cultural underpinning was observed by Davies and Fafchamps (2015) in the labour market in Ghana. Employees exerted less than expected effort and yet received the

desired compensation from employers. They argued that the phenomenon has its roots in the culture of the people of Ghana, where employers are perceived as wealthy individuals by employees and are supposed to provide a living for employees. Employees may, therefore, free ride on employers and find nothing much wrong with their behaviour.

### **5.5.5 Contract breach resolution methods**

Failure to trust a contract partner in a subsequent trading relationship is the major approach to contract breach employed by farmers while buyers relied on contract termination. The suitability of contract termination as a contract breach resolution method is backed by the literature on informal contracts. Farmers' lack of trust for buyers as a response to a contract breach can, however, not be described as a contract breach resolution mechanism. Instead, it is a problem created out of contract breach. Trust has been described as fundamental in contracts, particularly if agreements are not backed by formal written documents, commonly seen in Sub-Saharan African food markets (Fafchamps, 2004). The problem is that lack of trust has implications on the stability of the contractual relationship. As the results indicate, the trust problems are generated by buyers' failure to show up to purchase the contracted product, payment reduction, defaulted payment, and failure to honour input promise. If the farmer cannot be sure of the buyer's commitment to the verbal agreement entered with the buyer for the sale of his product, extra-contractual sales become the alternative option. Breakdown of trust can, thus, be considered a major contributing factor to side-selling in the value chain and suggest that interventions to mitigate side-selling must also address trust problems.

## **5.6 Conclusion**

The globalization of agri-food systems has led to a need for highly coordinated food value chains. Contract farming has become an important coordination tool between upstream food growers and downstream agribusiness firms. However, side-selling continue to negatively affect contract farming. To investigate how the design of the contract farming arrangement, otherwise known as the choice of contract terms affect side-selling, a conceptual framework was developed, which argues that, if the choice of contract terms are shaped by the uncertainties of the transaction out of which arises side-selling, then side-selling must be limited in contracts. This section concludes the first part of the study which

aimed at investigating contract terms and how they affect side-selling in the Ghanaian vegetable value chain contracts.

The study found market specification and informal verbal contracts as the major types and forms of contract agreements, respectively in the Ghanaian vegetable value chain. Contract terms include delayed payment, variable contract price which is set 5 days before the required date for product delivery, shorter contract duration (frequent switching of contract), farm gate delivery of the contracted product, and 3 times farm monitoring per production season. Also, contracts engage farmers who are associated with a form of farmer-based groups. Fewer contracts involve buying firms and farmers coming from the same community and contract farms are located 65km away from an alternative market that offers an opportunity for side-selling. From the conceptual framework, the choice of contract terms can drive or mitigate side-selling depending on how they are shaped by the uncertainties that generate side-selling. The results of the study show that the choice of some important contract terms failed to address transaction uncertainties and consequently increases the likelihood of side-selling. Variable contract price which is set 5 days before the required date for the product delivery increases the chances of side-selling. From the conceptual framework, price options can be a major source of uncertainty due to the volatility of the spot market price. A fixed contract price will lead to side-selling when the spot price increases. For a variable price to be successful against side-selling, it must be flexible, meaning that even if it has been agreed some days earlier, there must be a provision to update it to reflect the current spot market price on the day of delivering the product. The results show that while contract price is variable, and agreed 5 days earlier, buyers may not update it. Side-selling is also driven by delayed payment. A delayed payment generates uncertainties, considering that buyers may default payment. Also, Ghanaian vegetable farmers are mostly smallholder resource-poor and may not be able to wait for a later date to receive payment. The choice of delayed payment means the buyer's contract terms choice is not informed by the uncertainties of the transaction. Immediate cash payment at the point of sale eliminates the uncertainties. There is a failure of the institutions for public ordering in enforcing contracts in Sub-Saharan agricultural markets, particularly between food growers and buyers. The role of contract duration in an informal contract is to allow for a repeated interaction and implementation of the threat of contract termination as

contract enforcement. If the contract specifies a shorter duration, farmers have no future contract to protect and the use of the threat of contract termination as enforcement cannot be credible. Farmers will indulge in side-selling if a side-selling opportunity arises.

On the other hand, contract terms choices that are shaped by the uncertainties in the value chain minimizes side-selling. Farm monitoring, production management contracts, and contract farms distant away from alternative markets address the uncertainties in the value chain that are like to generate side-selling. Farm monitoring reduces the information asymmetry between the buying firm and the farmer, which is a source of uncertainty on units of output produced on the farm. Similarly, in production management contracts, the increased presence of the buyer on the farm allows him to verify output and thus, reduces farmers' chance of under-reporting yield from the farm. Locating contract farms away from alternative markets limits side-selling opportunities for farmers.

## CHAPTER SIX

### Investigation of Double Moral Hazard

#### 6.1 Introduction

As it was shown in the first five chapters of this dissertation, particularly in the previous chapter, contract breach is common in African markets. Most of the contracts celebrated in Ghana are informal and therefore may not be legally binding or enforceable. Moreover, as have been seen, Ghana does not have reliable institutions to which either the buyers or the sellers could appeal to resolve their disputes. To investigate mechanisms to resolve side-selling in contracts, first a field survey of the Ghanaian vegetable chain was conducted to understand how the terms of a contractual agreement can affect side-selling. An important transaction characteristic in the food chain that potentially leads to opportunism like side-selling is uncertainties. The field study, therefore, focused on how existing contract terms resolve side-selling by limiting sources of uncertainties that potentially generate side-selling in contracts. The results of the survey were mixed. While some contract terms limit side-selling, others give room for side-selling. A further investigation of other forms of breaches in the food chain showed that both buyers and sellers breach contracts, the former by failing to collect the products at the time of harvest or imposing a price reduction and the latter by side selling. The results also showed there is a trust issue between the parties, specifically the farmer failing to trust the buyer to fulfill contract promise, which contributes to side-selling. A robust mechanism to resolve breaches thus becomes useful, especially that which enhances the seller's trust. This leads to the second part of the study, which assesses the relative impact of mandatory and voluntary enforcement of buyers' contract offers on sellers' contract breach.

This situation can be examined through the lens of contract theory. What has been described is a buyer-seller arrangement, where a buyer aims to reduce the financial, supply, and other risks of getting a product from a seller, who in turn wants to secure a price for his or her output. This is a case of contract non-compliance which relates to actions taken by both agents and, therefore, can be classified as a moral hazard or hidden action. Contract theory is an economic framework to model interactions between two or more parties as strategic games. In moral hazard models, it is assumed that one of the parties has private information



on their actions. The previous chapters revealed that the reality in produce markets in Ghana is more complex than the standard models used in contract theory, as there is a double moral hazard from both buyer and seller when they shirk on their contractual commitments. Thus, to better understand and examine this situation, this chapter reviews the literature on contract theory, focusing on buyer-seller moral hazard models. This chapter is divided into four further sections; next, an overview of contract theory is presented, which will shed light on the best theoretical models to examine the problem identified. Then, the second section reviews the extant research applying contract theory to food chain coordination problems. Finally, the third section reviews the experimental work on buyer-seller relations with moral hazard and the last follows with a conclusion.

## **6.2 Review of contract theory**

According to the theory and application of the economics of contract by Brousseau and Glachant (2002), a contract is an agreement between two (or more) economic agents transacting a given good or service in which each agent makes a reciprocal commitment to the other concerning their expected behaviour in a coordination arrangement. Each agent in this transaction has private information about their actions and characteristics that may affect the transaction, but neither will disclose that information without some form of compensation. Thus, contract theory examines transactions under informational asymmetry. In examining the economics of contracts, Salanié (2005) observed that information asymmetry occurs when one party has more or better information regarding his action than the other party in the transaction

Information asymmetries constrain both agents and often lead to information rents and inefficient transactions. In contract theory, the transaction between agents is modelled as a non-cooperative game with asymmetric information, where one of the parties (the principle) makes a take it or leave offer to the other, i.e the agent (Salanié, 2005). Given the variety of situations where contract theory is applied, it is useful to distinguish between static (one-shot) and dynamic (repeated) interactions between agents. Another distinction is between complete and incomplete contracts. Salanié (2005) suggests three categories (or families) of models: adverse selection, signalling, and moral hazard models which are

corroborated by Besanko *et al.* (2009) and Gershkov and Perry (2011) in their analysis of the economics of strategy and dynamic contracts with moral hazard and adverse selection respectively. They note that in adverse selection models, the principal lacks information about the agent's characteristics or type. For example, a downstream agribusiness firm may face an adverse selection problem when there is no information about the ability of the upstream producer to deliver a commodity. Signalling models are those where the agent moves first, revealing some of his information. For example, a farmer could invest in a new irrigation system to show his ability to produce vegetables. In moral hazard models, the principal cannot fully observe the agent's actions (Besanko *et al.*, 2009). A downstream agribusiness firm faces a moral hazard problem if actions such as side-selling or diversion of inputs meant to be applied to the contracted product are unobservable. Contract theory is then an appropriate framework to examine how to design a contractual arrangement between two (or more) transacting parties in the presence of informational asymmetry. Different contract types emerge depending on the extent agents could specify contingencies. Consequently, the type of contract determines the strategy to motivate agents to take appropriate action.

### **6.2.1 Complete contract**

First, the case of a complete contract is described. This is when all variables that may affect the transaction are taken into account (Salanié, 2005). The agent can withhold or manipulate some important private information or influence effort, resulting in enforcement problems. The theoretical literature proposes an incentive contract as a mechanism for inducing an agent to disclose private information or deliver higher effort (Brousseau and Glachant, 2002; Besanko *et al.*, 2009). Incentive contracts incorporate information that is observable and verifiable by a third party. This involves the use of performance measures based on inputs or outputs (Besanko *et al.*, 2009). For example, an incentive contract between an agribusiness buying firm and an upstream producer may specify the premium price for higher quality. Producers may utilize the best available information known to them and expend much effort undertaking practices that improve quality.

Similarly, a principal may design a contract with a payment scheme where the agent's wage is linearly correlated to his observed output (Brousseau and Glachant, 2002), meaning agents receive variable wages depending on effort level. The potential problem, however, is that some states of the world, the agent cannot control, could affect output, predisposing the agent to risk. In cases where the context on which the actions of the agent may be affected by external factors beyond his/her control, a complete contract will have to include provisions to account for uncertainties from the environment, otherwise, the contract may not be accepted by a risk-averse agent. A risk-averse agent may want insurance for some states of the world influencing output. For example, this may involve a fixed payment with an additional compensation contingent on states of the world where the environment is more or less favourable and the agent puts in a higher effort (Brousseau and Glachant, 2002).

### **6.2.2 Incomplete contract**

A contract is considered incomplete when it is not conditional on all the relevant variables affecting the transaction or when it can be renegotiated (Salanié, 2005). In other words, when a contract cannot describe and specify every possible contingency at the time of contract negotiation, that contract is said to be incomplete. Most real-world contracts are incomplete as has been shown by Grossman and Hart (1986) and Hart and Moore (1990) in their work on property rights and the nature of the firm. Incomplete contracts may involve renegotiation of contractual terms ex-post when some states of the world not possible to describe ex-ante become known. Since a renegotiation of terms may be triggered at any point ex-post, agents may consider the ex-ante contracted terms as not credible and would not have sufficient incentives to commit to the contract ex-ante. Thus, incomplete contracts are inherently vulnerable to hold-up; a cooperation failure arising from the concern that a party may renege on a contract after the other party has committed to a future transaction.

In Grossman and Hart (1986) and Brousseau and Glachant (2002), a design of a suitable ownership structure has been proposed as a possible mechanism to resolve hold-ups in an incomplete contract. They show that the allocation of residual rights of control (the property

right approach), which includes all ex-ante non-contractible variables, to a party, induces appropriate action from her in the event of a contingency, and thus removes the need for ex-post renegotiations. Williamson (2000), however, argued in his new institutional economics that the property right approach to resolving hold-up neglects ex-post inefficiencies, which may lead to contract non-performance. Hart and Moore (2008) advanced this argument in their work titled ‘contract as a reference point’ by noting that a contract may provide a reference point (a feeling of entitlement), and that ex-post performance (hold-up or not) will depend on whether an agent receives her entitlement relative to the outcome, as detailed in the contract agreement. An agent will deliver a consummate ex-post performance if she receives the entitlement due to her but will shirk if she feels short-changed. Other theoretical literature has considered alternative approaches in resolving the hold-up problem. For example, in their analysis of unforeseen contingencies and incomplete contracts, Maskin and Tirole (1999) argued that the design of the contract plays a major role in resolving hold-ups.

#### **6.2.2.1 Relational contracts**

Relational contracting is another solution mechanism to coordination failures due to moral hazard in incomplete contracts. Motivated by the same reasons underlying incomplete contracting, such as parties’ inability to specify all possible contingencies, relational contracts are informal agreements between parties sustained by the value of future relationships (Baker *et al.*, 2002; Gibbons, 2005). In studying the theories of the firm Gibbons (2005) observed that relational agreements are normally in the form of unwritten codes of conduct. These codes of conduct are accepted standard behaviours expected of an individual or are a set of norms that parties are expected to follow even when they are not told to. Nonetheless, due to differences in cultural context, codes of conduct may vary from one environment to another. Fafchamps and Gubert (2007) described this agreement as open and flexible. This suggests the non-enforceability of obligations and the fact that parties can drop out of the agreement unconstrained. Apart from the fundamental basis for relational contracts as contractual incompleteness; the difficulty in designing a complete third-party verifiable contract, the nature of market interaction in certain economies favours the use of relational contracts. For example, in some economies, the fragmented market interactions and rudimentary nature of institutions for public order would make public enforcement problematic if a complete contract was possible in the first place. This has

been observed by Cungu *et al.* (2008) in his examination of investment with weak contract enforcement in Hungary. Also, as noted in the contract farming theory and practice by Eaton and Shepherd (2001a), the small nature of market transactions means that the transaction costs involved in lawsuits in the wake of a contract breach are likely to be prohibitive even if well-functioning legal institutions are readily accessible.

Moral hazard is particularly profound in relational contracts, but Fafchamps (2004) observed in his work on market interactions in Sub-Saharan Africa that it could be mitigated through the application of self-enforcement mechanisms. This implies an economic agent could be induced to comply with a non-binding agreement in a market transaction if a mechanism exists that penalizes breaches. According to him, these mechanisms involve the termination of a relationship with a party who breaches a contract, and reputational damage. Similarly, in studying the role of public and private order institutions behind the market stage, Platteau (1994) noted that the use of mechanisms that induce guilt and shame in offenders can be effective contract enforcement strategy where public enforcement is lacking. The use of coercive action which may be legitimate or illegitimate (Gambetta, 1993; Braguinsky, 1999), are also important informal contract enforcement strategies. For example, the resort to the mafia institution for private protection in Silicia, Italy has been noted by Gambetta (1993). Illegitimate means of enforcing a contract is, however, not an accepted norm, and depending on the jurisdiction may not be permitted at all by the law. Notwithstanding, in some countries people may employ these tactics, including bribing the police to enforce a contract.

Termination of a relationship is based on a *quid pro quo*; which means that an agent behaves if the other has behaved (Baker *et al.*, 2002). This mechanism, therefore, has an inherent threat of retaliation for an agent's actions. Important forms of retaliation involve a punishment strategy that suspends future contractual relationships with the defaulting partner, and this is applicable if the contract involves a continuous relationship in the first place. Hence repeated interaction is the basis for contract termination as an enforcement mechanism. Repeated interaction means that the contracting parties trade continuously into the future, but the trading relationship is suspended immediately a party shirks an obligation

(Gow *et al.*, 2000; Baker *et al.*, 2002). The fear of losing one's long-term trading relationship, therefore, induces contract enforcement. Fafchamps (2003), however, argued that for the threat of contract termination to induce enforcement, the parties' relationship must be worthy of preserving.

Reputational damage is also based on retaliation, but in this case, inflicted by a group of people outside the trading relationship and who are future potential trading partners (Greif, 1993; Fafchamps, 2003). This mechanism relies on information sharing on contract compliance within a group, which threatens damage to one's reputation. Reputational damage which can result in the loss of a potential future trading partner induces enforcement (Kandori, 1992; Mouzas and Blois, 2008). Guilt is internal and the ability to feel guilty for a failure to comply with promises in trade relationships differs across individuals (Fafchamps, 2004). Shame comes from disapproval by others. While one can feel guilty for an action even if no one knows about it, shame, on the other hand, is an emotional device that relies on information sharing to affect behaviour. The mechanism that exposes contract non-compliance and induces guilt and shame could, therefore, mitigate breaches in the absence of formal enforcement. In Benson (2011) and McMillan and Woodruff (2000), coercion as an enforcement strategy uses two strategies; it either relies on legal action such as the court system, which may award costs against or seize the assets of, an agent that breached trade agreement or may rely on illegitimate force such as hiring of thugs or bribes to a policeman to enforce the agreement (Gambetta, 1993). Generally, addressing moral hazard in relational contracts involve behavioural principles.

### **6.3 Buyer-seller contracts in food chains**

There is a growing literature using contract theory to examine supply chain coordination in food markets. As consumers increasingly value foods with specific attributes, buyers for retailers and the food industry are using contracts to mitigate risks. Food production is stochastic such that neither the buyer nor the seller can exactly determine output ex-ante (Barrett *et al.*, 2012), hence quantity is not fully-contractible. The seller observes output ex-post but not the buyer. The seller thus can under-declare output, subjecting the contract to moral hazard from the seller's side. In contrast, the seller does not know the buyer's

type. The buyer is equally free to renege on contract price once the seller has delivered the commodity, subjecting the relationship to moral hazard from the Buyer. The Buyer has a last-mover advantage, and both interact once. The informational asymmetry and the possibility of shirking from both the buyer and seller establishes a condition for double moral hazards. This scenario describes the uncertainty of many in the food industry and services, notably the food industry where production is dependent on ecological and weather conditions (Barrett *et al.*, 2012).

Kunte *et al.* (2016) investigated breaches in contract farming experiments and the role of private ordering in mitigating side-selling. They examined the effectiveness of three informal enforcement mechanisms on side-selling: repeated interaction; reputation; and communication in a relational contracting setting. Repeated interaction and reputation functioned effectively as an informal enforcement mechanism, significantly limiting side-selling. On the other hand, communication failed to impact side-selling. Communication was, however, a one-time event in their studies.

Romero Granja and Wollni (2019) examined the implication of exposure to a contract breach by buying firms, in the form of delayed payment, on seller's trust in a trust game experiment in the broccoli supply chain in Ecuador and how a positive signal of trustworthiness affects trust. They found that a positive signal sent by the firm triggered a positive response from the farmer, increasing trust. Their results show that in a market where there is coordination failure, ex-ante credible positive signals could limit opportunistic behaviour and enhance coordination. Gow *et al.* (2000) investigated private (informal) contract enforcement mechanisms in a Slovakian sugar processing firm where firms breached contract through delayed payment. They found that signaling trust through an upfront investment by the firm, and farmers committing to a long-term relationship, restored farmers' relationship with the firm.

Informal enforcement mechanisms have also been studied in related incomplete or relational contracts in labour markets. For example, Davies and Fafchamps (2015) studied

the impact of limited enforcement and reputation on employer-employee relationships in Ghana and the UK. They observed that the threat of contract termination and reputational loss induced contract enforcement in relational contracts in the UK. In the Ghanaian labour market, however, they found no evidence of the impact of contract termination and multilateral reputation as an enforcement mechanism. Their findings suggest that the impact of repeated interaction (threat of contract termination) and reputational mechanisms on contract enforcement may not be universal, particularly in developing countries. Brown *et al.* (2004) investigated the impact of long-term relationships and the threat of contract termination on contract enforcement in a labour market interaction predisposed to moral hazard. They observed that employers penalizing employees for exerting lower effort through contract termination had a greater effect on contract enforcement when third party (formal) enforcement was absent.

The impacts of other informal mechanisms on resolving moral hazard in incomplete contracts have also been studied. For example, Charness and Dufwenberg (2006) examined the impact of communication in a one-shot principal-agent game with moral hazard and found that communication, as statements of intent, enhanced cooperation in a partnership. Similarly, communication has been shown to mitigate moral hazard in other social dilemmas studies (Ellingsen and Johannesson, 2004; Brandts and Cooper, 2007; Ben-Ner and Putterman, 2009). The impacts of promises and feedback on labour relations have been explored in a gift exchange experiment. These studies noted that promises increase the effort level exerted by agents and enhanced coordination between parties (Vanberg, 2008; Davies and Fafchamps, 2017; Ederer and Stremitzer, 2017; Di Bartolomeo *et al.*, 2019).

The above empirical studies relied on relationship building (relational contracting devices) to resolve hazards. In recent moral hazard studies, the effect of voluntary institutions that could mitigate moral hazard and ensure profitable trade has been investigated. For example, Andreoni (2018) examined the impact of a ‘satisfaction guarantee’ on moral hazard in a buyer-seller relationship. A satisfaction guarantee implies the buyer can return a good for a full refund if not satisfied with the quality of the good. He found that selling a good whose value cannot be ascertained by the buyer (predispose to seller’s moral hazard but



with a satisfaction guarantee), significantly reduced moral hazard. Coricelli and Luni (1999) analyzed theoretically and experimentally double moral hazard in a market for durable goods with information asymmetry and found that buyers paid higher prices when a warranty was provided. The warranty signaled the quality of the goods and assured buyers that they are not being cheated even though they did not have information about the durability of the good.

#### **6.4 Experimental analysis of buyer-seller contracts**

Experimental methods have been increasingly used to investigate alternative solutions to the enforcement of incomplete contracts. Recent examples in the agricultural supply chain include Romero Granja and Wollni (2019) and Kunte *et al.* (2016). Romero Granja and Wollni used a field experiment to examine opportunistic behaviour among broccoli farmers while Kunte *et al.* (2016) used a laboratory experiment comprising student subjects to investigate side-selling and informal enforcement strategies. Examples abound in the labour market as well. For example, Brown *et al.* (2012) employed a laboratory experiment methods to explore self-enforcement in relational employer-employee labour contracts. In Charness and Dufwenberg (2006), an experimental method was used to investigate mechanisms for cooperation in a partnership. Similarly, in a relational labour market experiment in Ghana, Davies, and Fafchamps (2015) used a laboratory experiment. A recent study by Davies and Fafchamps (2017) and Ederer and Stremitzer (2017) examining how communication, in the form of promises, pledging, praises and shaming, increase efforts level of employees in a labour management, involved a laboratory experiment.

#### **6.5 The role of institutions in minimizing moral hazard**

The new institutional economics has expounded the transaction cost theory by recognizing that social capital, collective action, and rules are an important aspect of economic activity. The role of social capital in minimizing the costs of uncertainty and market transactions was recognized by Putnam (1993) when he examined social capital and public life. He noted that social capital which entails social connections, networks, norms, and trust, facilitates societal cooperation which ultimately enhances economic performance. This is corroborated by the findings of Ensminger (2000) in an experimental study in East Africa

on why institutions matter in contracts and organizations. Social capital and network can thus be explored to explain economic behaviour. In examining the evolution of institutions for collective action and the psychosomatics of free-riding, Keohane (2010) and Delton *et al.* (2012) respectively, observe that collective action which involves individuals acting towards a common goal is an important mechanism to overcome free-rider problems in economic transactions and improves economic outcomes. But as shown by Bergstrom *et al.* (1992) in the provision of public goods, a free-rider problem emerges if private incentives faced by economic agents are not aligned with their shared goals. Meaning voluntary cooperation that is mutually beneficial but privately costly will not be observed by economic agents.

A collective action problem or free-rider problem can be overcome by either an external or internal pressure if economic agents can design and abide by a set of rules or less formal arrangements codified in social norms. This includes restraining opportunistic behavior through internalized social norms or enforcement of externally imposed rules. Another important mechanism for collective action mitigation of free-riding is noted by Ostrom (2000) and Olson (2012) in their analysis of collective action and the evolution of social norms and the logic of collective action, respectively. They argued that collective action can be facilitated by the norms of reciprocity. The norms of reciprocity can lead an economic agent to undertake pro-social action when they expect the same response from others.

### **6.5.1 The concept of a deposit**

It has been shown from the review in section 6.3 that institutions can affect behaviour either through internalized social norms or an external imposition of restriction on misbehaviours. This section describes the concept of a deposit as an institution and how it may affect behaviour. A deposit is a financial pre-commitment for the future execution of a transaction once an agreement to perform the transaction has been concluded. In a contract between a buyer and a seller for the delivery of a commodity, the seller faces the risk of contract breach from the buyer in the form of non-payment or contract price reduction. By depositing an amount equivalent to the value or part of the value of the contracted product with a third party, which promises a reimbursement of the seller in the event of a contract

breach by the buyer, offers protection to the seller. The purpose of a deposit in the context of a contract has different dimensions. First, a deposit can be considered as an external institution that restricts the depositor's option to renege on a contract. Second, a deposit can be made voluntarily as an internal arrangement by the buyer in which case it signals the buyer's commitment and trustworthiness in the contractual arrangement. The application of a deposit in a strategic interaction is relevant in a market with trust issues and concerns about an ex-post moral hazard or free riding. In the former case of an imposed deposit, where renegeing or moral hazard is externally restrained, the beneficiary seller must respond by not engaging in moral hazard if a previous inclination to moral hazard has been a reaction to an anticipated ex-post renegeing from the other buyer. In the case of a voluntary deposit by the buyer, the norms of reciprocity induce the seller not to free-ride or engage in moral hazard. The contract deposit scheme described here can be administered by a third-party organization that takes and hold deposits from a prospective buyer who seeks to engage sellers in a contractual arrangement.

The concept of a deposit has been applied in the financial industry in what is termed as deposit insurance or deposit guaranteed schemes (Anginer and Demirguc-Kunt, 2018). In the financial sector, the purpose of deposit insurance is to safeguard the confidence of customers of a bank by promising a reimbursement of depositors of their savings in the event of default by the bank. These deposit insurance or guaranteed schemes are administered by deposit protection corporations. For example, in Ghana, there is a Ghana Deposit Protection Corporation that protects bank customers against the loss of an insured deposit if a specialized deposit-taking institution fails.

## **6.6 Review of reciprocity and belief on contract enforcement**

This section reviews literature focusing on how behavioural aspects such as those described in the context of relational contracts were used to mitigate contract breach. Particularly, emphasis will be placed on studies that used reciprocity and beliefs. The Standard economic theory considers human behaviour as purely self-interest seeking. For example, Williamson (1975) in examining markets and hierarchies argued that under conditions of imperfect information, such as exist in incomplete contracts, market transactions involve self-interest

seeking behaviours. Also, theory suggests that in a contractual arrangement, agents may prefer to serve their selfish interests rather than cooperate. However, advances in theories of human behaviour posit that human actions may deviate from purely-self-interested behaviour, suggesting that humans exhibit considerable reciprocity in social interactions (Dufwenberg and Kirchsteiger, 2004; Falk and Fischbacher, 2006). Reciprocity is a person's behavioural response to a perceived kindness or unkindness of another. It implies that people would respond to a friendly action with another friendly action, and would be nicer and more cooperative, but would retaliate to an unfriendly action. Two models that account for reciprocity have been noted by McCabe *et al.* (2003) in their studies on positive reciprocity and intentions in trust games. In an intention-based model, they note that players respond to intentions rather than actions. Thus, a player's behaviour is influenced by how he thinks the other player intends to behave. This argument is upheld by Wilkinson and Klaes (2017) in their introductory behavioural economics literature. Thus, with intention-based reciprocity, one needs not to observe actions ex-post. For example, in a strategic interaction with incomplete information, a player's intentions, kind or unkind, toward the other may depend on what he believes the other player's intentions are. In an outcome-based model, on the other hand, McCabe *et al.* (2003) argued that reciprocity is not attributable to intentions but rather driven by intrinsic properties of the observed outcome. In examining fairness and retaliation in the economics of reciprocity, Fehr and Gächter (2000) described reciprocity as either positive or negative. They note that in positive reciprocity, an agent responds to a kind action with similar kind action, while in a negative reciprocity a player retaliates to an unkind action.

In a gift-exchange game to examine the impact of fairness on prices, Fehr *et al.* (1993) reported some evidence of reciprocity. He observed that when buyers offered a price substantially above the market-clearing level in a one-sided auction, sellers reciprocated with higher quality delivery. In an experiment designed to test trust and reciprocity in an investment game, Berg *et al.* (1995) found significant reciprocity in human behaviour, and in an ultimatum game, players rewarded action by rejecting low offers from trading partners (Camerer and Thaler, 1995; Jolls *et al.*, 1998). Similarly, players in a social reciprocity game indicated a willingness to penalize free-riders even when doing so incurred a personal cost (Carpenter and Matthews, 2004). These show that economic agents are not purely self-

interest seeking and sellers would respond to behavioural interventions such a voluntary deposit or otherwise by a buying firm in a contract agreement.

According to Rabin (1993), when information is incomplete, such as in strategic interaction, behaviour cannot be dependent on outcomes. Instead, players' behaviour depends on his belief about the behaviour of the other player. A preference for fairness will result in two equilibria in pure strategies. Thus, players either cooperate or defect. Players will have to learn about belief if the payoff depends on beliefs. However, as argued by Battigalli and Dufwenberg (2009) in a dynamic psychological game, belief, unlike actions, cannot be observed ex-post, and players may not behave according to equilibrium predictions due to mistaken beliefs. The effect of belief on cooperation has been examined empirically. It is observed that people's belief about the behaviour of others affects their behaviour and that people may exhibit trustworthy behaviour when they believe the other is trustworthy (Charness and Dufwenberg, 2006; Ackermann and Murphy, 2019). In Ackermann and Murphy (2019) peoples' belief about the behaviour of others in social dilemmas determines their behaviour and that people cooperate conditionally on others' cooperation. Belief elicitation where a player makes an explicit statement of her expectations on how much units (usually money) the other player will return have often been used to measure the correlations between stated expectation (belief) and trust in studies such as Berg *et al.* (1995), Bellemare and Kröger (2007) and Sapienza *et al.* (2013). These studies have found a strong correlation between stated expectations and trust. Variations in trust could, however, arise due to variation in stated belief. In studying beliefs and actions in trust games, Costa-Gomes *et al.* (2014) argued that it is likely that a variation in trust could be due to some observable differences among participants, such as players' type. For instance, a player who is likely to trust another may also be relatively trustworthy and may project his own type unto others in strategic interactions.

## **6.7 Summary**

The purpose of this chapter was to review contract theory, which is a suitable theoretical foundation for the problem being examined. From a brief review of the concepts of contract theory, it is argued that the situation described in the earlier chapters can be suitably examined using incomplete contract models with double moral hazard. The role of

institutions, in the new institutional economic framework, as interventions that influence behaviour of economic agents in a market exchange was reviewed. Then, the next section proceeded to identify and summarized previous work using these types of models in the analysis of supply chain coordination problems. Recently, there has been an increased use of experimental methods to empirically test hypotheses from incomplete buyer-seller models. The third part of this chapter reviewed recent work using experimental methods to investigating hypotheses emerging from contract theory models.

## CHAPTER SEVEN

### A Buyers- Seller Model with Double Moral Hazard

#### 7.1 Introduction

The previous chapters have shown how contract breach is pervasive and impacts supply chain coordination as well as the development of African food systems. Furthermore, contract theory was introduced and proposed as a suitable theoretical framework to examine contract breach and its possible remedies. This chapter proposes a model to examine alternative solutions to mitigate contract breach. Specifically, a buyer-seller static model with moral hazard is proposed and analysed. This chapter comprises three sections, the first section sets the basic model and derives the first set of hypotheses. Then, section three presents the case where a hidden action is restricted from the principal. The fourth section introduces and examines the case where the buyer may opt to forego any changes to the contract price proposed. The final section summarizes the chapter and the main results.

#### 7.2 The basic setup

Consider a sequential one-shot contract game with perfect but incomplete information between a buyer and a seller. A buyer aims to get a quantity  $x$  of a given good upstream to sell for 10 monetary units per unit of product in a perfectly competitive market downstream. The buyer can either purchase from a seller, through a contract, or on the spot market. Assume that when using the spot market, the buyer can get a maximum of 11 units at the market price. The spot market price ( $p_m$ ) is generated from a random discrete uniform distribution and varies between 1 and 7. The contract offered by the buyer only specifies the price, which we notate as  $p_c$  and, as the market price, ranges between 1 and 7, i.e.  $p_c \in [1,7]$ , thus  $E[p_c] = 3.5$ .

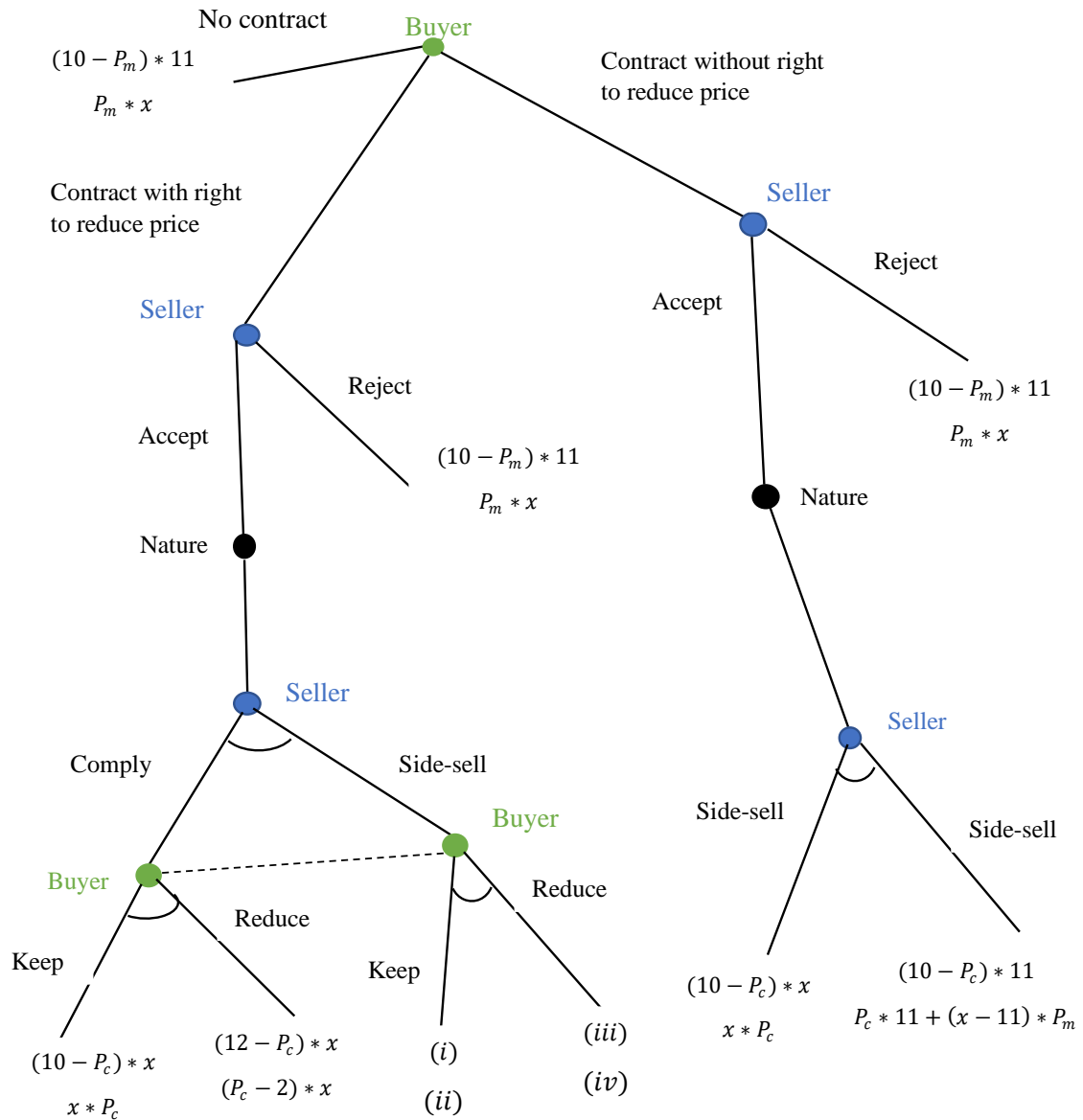
The seller produces and can also either sell the quantity produced in the market or accept a contract from the buyer. When the seller rejects a contract, the production is sold in the spot market at the going price. Assume the production has a fixed and a stochastic component, such that 11 units of the output are produced with certainty and an additional 9 units are obtained from a random discrete uniform distribution production process.

Thus, the total quantity produced  $x$  is defined as  $x \in [11,20]$ , with the expected quantity equal to 15.5. If the seller accepts a contract, he must deliver a minimum of 11 units of output to the buyer, however, the buyer expects all the output produced to be delivered. An important feature of this model is that once determined, the market prices are common knowledge. However, the quantity ( $x$ ) produced by the seller is only known to him. This leads to moral hazard from the seller's side, as he can side sell part of the quantity above 11 in the spot market at the going price.

We also consider moral hazard from the buyer, as once the supplier delivers on the contract, the buyer has a chance to review and lower the original contract price by up to 2 monetary units. Thus, our baseline model is a principal-agent relation with a double moral hazard. We then consider two variations to this main model. First, we take away the right of the buyer to review the price originally proposed. In other words, the original contract proposal is enforced, and the model is reduced into a standard single moral hazard case. Second, the buyer is given the option to fix the price by making a deposit and (voluntarily) foregoing the chance to reduce the price offered in the contract. Thus, the moral hazard model becomes a signaling game model. When the buyer foregoes the chance to reduce the price, the model becomes akin to the enforced contract, but because it results from a voluntary act it may lead to a reciprocal response from the seller.

Figure 7.1 describes the game in extended form. As can be seen, the game has 5 stages: first, the buyer decides whether to offer a contract. In the second stage, the seller accepts or rejects the contract. Then Nature moves, revealing the market prices to both players and the amount of product produced to the seller. The move of nature signifies a random event depicting the volatility of spot market price in African food markets and the unpredictability of farm yield. Observing the market price and the output produced, in the fourth stage the seller (should a contract have been accepted) decides how much product to allocate to the buyer and/or the market. Finally, in the fifth stage, the buyer decides whether to review the contract price and payoffs are determined.





Where:

$$(i)(10 - P_c) * 11; (ii) (P_c * 11 + (x - 11) * P_m); (iii) (12 - P_c) * 11; (iv) (P_c - 2) * 11 + (x - 11) * P_m$$

Figure 7. 1: Extended form version of a buyer-seller game with double moral hazard

The three variations of the model are all depicted in Figure 7.1. First, the far right of the tree shows the case where the buyer does not have the right to change the price. This is the case when the right to review the prices is withdrawn in the enforced treatment or when the buyer, voluntarily, opts out of the option to review the price. Second, the left side of the tree, starting on the buyer's node presents the case where the buyer retains the right to

change the original contract price. Next, the model is analysed and conjectures are proposed.

### 7.3 Double moral hazard model

This section examines the basic model of the game denoted in Figure 7. 1. Each agent's profit functions are defined and followed with an analysis of the baseline model when both agents can shirk on the contract. Recall that the principal earns 10 monetary units per unit obtained from the market or the seller. However, each unit delivered by the seller has an opportunity cost, which is the difference between the contract price and the market price. Also, note that the contract has a linear incentive scheme, but the quantity is not observable by the buyer. The profit of the buyer is dependent on the market price and, should she offer a contract, the quantity of output produced and delivered by the seller. Given the variables defined above, the profit function of the buyer is defined in general terms as:

$$10 * x - p_i x \tag{3}$$

Where  $i = m$  or  $c$  respectively denoting the market or the contract price. Note that the lower the price at which the buyer can get the product the higher her profit. Thus, if the buyer proposes a contract, she not only reduces uncertainty in price but also may increase the quantity to be sold downstream. However, it is assumed that, if a contract is not offered, the maximum amount of  $x$  the buyer can get in the market is 11, thus her profit is:  $110 - 10p_m$ . That is the higher the market price the lower the profit. Assuming risk neutrality the buyer can secure better profit offering a contract to the seller.

Turning to the seller, his profit coincides with his total revenue and is linear in quantities produced. Thus, the seller's profit function is defined simply as:

$$p_i * x \tag{4}$$

Consequently, given the structure of the game described above the profit of the buyer is defined as follows:

$$\pi_b = \begin{cases} (10 - E[p_m]) * 11 & \text{if contract is not accepted} \\ (12 - p_c) * x & \text{if contract is accepted} \end{cases} \tag{5}$$

Note that a rational buyer will always reduce the price of the contract maximizing to maximize his profits. Similarly, the profits of the seller are given by:

$$\pi_s = \begin{cases} x * E[p_m] & \text{if contract is not accepted} \\ x * (p_c - 2) & \text{if contract is accepted} \end{cases} \quad (6)$$

From these expressions, optimality conditions and hypotheses could be derived. Note, however, that this is a model of hidden action and both agents can breach the contract. So, depending on the market price and the quantity produced, the agents can breach to maximize their profits. Since the assumption is that both agents are risk-neutral and rational we solve by backward induction for the final stage sub-game equilibrium. First, note that if the seller accepts the contract offer, he is obliged to deliver 11 units of output at the contract price. Moreover, recall the buyer can reduce the contract price by up to two monetary units. Consequently, the seller assumes the buyer will shirk on the contract. So, the seller will only accept a contract that meets his reservation utility, in other words, the contract price needs to meet the following participation constraint:

$$(p_c - 2) * x \geq x * E[p_m] \quad (7)$$

However, this is only a necessary condition. For the contract to be incentive-compatible the principal needs to consider the possibility of side sell, in other words:

$$(p_c - 2) * x \geq (p_c - 2) * 11 + (x - 11) * p_m \quad (8)$$

Which leads to

$$p_c \geq p_m + 2 \quad (8)$$

Using these expressions and profit function in (3) and (4) we derive the following hypothesis:

1. The buyer offers a contract price equal to the expected market price plus 2 and, regardless of the seller's action, will reduce the price offered by two to maximize profits.
2. The seller will not accept a contract unless the price offer is at least equal to  $E[p_m] + 2$
3. The seller will shirk whenever the market price exceeds the contract price, more specifically the seller will shirk unless:  $p_m > p_c - 2$ .

#### 7.4 Single moral hazard model

This second case considers the possibility of a policy that enforces the contract proposed by the buyer. This turns the original model into a classic single moral hazard problem, as now only the seller can breach the contract. Note that the only change to the structure of the game is that, now after the seller decides on his action, the payoffs to both players are determined. Examining the right-hand branch of the tree in Figure 7.1, it can be seen that the buyer still has an incentive to offer a contract, but the fundamental difference is that the seller now knows that the price is binding so the offer is entirely credible. Moreover, the buyer can simply offer the expected price. Consequently, the profit functions for the buyer can be rewritten as:

$$\pi_b = \begin{cases} (10 - E[p_m]) * 11 & \text{if contract is not accepted} \\ (10 - p_c) * x & \text{if contract is accepted} \end{cases} \quad (10)$$

$$\pi_s = \begin{cases} x * E[p_m] & \text{if contract is not accepted} \\ x * p_c & \text{if contract is accepted} \end{cases} \quad (11)$$

While the buyer makes a binding contract offer, the seller still can side sell if doing so increases his profits. He will do so if the market price is higher than the one in the contract offered. Note that in this case, we do not expect reciprocity from the seller, as the right to

lower the price was exogenously taken from the buyer. The participation constraint for the buyer is defined from the following condition:

$$p_c * x \geq x * E[p_m]$$

Thus, if the buyer offers a contract equal to the expected market price, the seller accepts it. Turning to the incentive compatibility contract, similarly to our analysis in the previous section the seller will breach unless:

$$p_c * x \geq p_c * 11 + (x - 11) * p_m \quad (12)$$

Similar to the analysis above, manipulating this expression yields:

$$p_c \geq p_m$$

In others, only if the contract price is larger than the market price, while the contract is completed.

This leads to the following hypothesis:

4. The buyer will offer a contract price equal to the expected market price.
5. The seller will not accept the contract offer unless the price is at least equal to  $E[p_m]$
6. The seller will shirk whenever the market price exceeds the contract price, more specifically the seller will shirk unless:  $p_m > p_c$ .

## 7.5 Double moral hazard model with optional binding price offer

This last case investigates the possibility of a voluntary commitment from the Buyer to withhold a decrease in the price offered. The last section of chapter 5 discussed how beliefs and reciprocity may affect the behaviour of agents in a transaction. While the neoclassical model states that human behaviour is purely self-interested, an increasing body of evidence from behavioural sciences has shown that humans often deviate from purely self-interested behaviour. The experimental economics literature has shown that reciprocity is often observed in both static and repeated interactions. Reciprocity can be defined as a response to another agent's perceived or actual altruistic behaviour (Falk and Fischbacher, 2006; Wilkinson and Klaes, 2017). However, an altruistic act may originate from a belief about the contract part behaviour. According to Rabin (1993), altruistic behaviour depends on an agent's belief about the response of the other party. Thus, if an agent believes an act of

kindness or a self-restriction will be reciprocated such that both agents in a transaction are better off, that is a viable strategic option. Now, in repeated interactions, where an agent can learn about the other's actions and reward or punish misbehaviour, beliefs, and reciprocity have been shown to work. However, in one-shot games, the consequence of beliefs on reciprocity can only be observed ex-post and, therefore, most agents will tend to believe that acts of kindness will not be reciprocated.

Thus, in this case by fixing the price the buyer believes the seller will reciprocate and maximize profits by assuring the seller does not sell in the market. However, since this is a one-shot game, the buyer cannot observe or punish the seller if he does not comply with the contract. Thus, the commitment to a binding contract is quite risky. Still, if the buyer decides to withhold the right to change the contract price, the game becomes akin to the single moral hazard described in the previous section. Consequently, the buyer simply has to offer the expected market price. If the buyer decides against giving up his right to reduce the contract price offered, we fall in the earlier case of double moral hazard.

The profit functions for the buyer and seller are identical to the ones above. When the buyer decides to offer a binding price contract to the seller, her profit function is the same as that in equation 9 above. Otherwise, if she retains the right to keep the option to reduce the contract price the buyers' profit is the one described in expression 3 in section 6.2.1. The analysis is also like the one in the previous sections, the conjectures are slightly different though:

7. In this case, the buyer still always offers a contract and will not forego the right to reduce the price. If so, the contract will only be accepted if:  $p_c \geq E[p_m] + 2$
8. The buyer will always offer contract and will reduce the contract price ex-post even if she believes the seller delivered the entire output of the commodity.
9. The seller will always breach the contract if the buyer does not commit to a binding contract and the market price is higher than the contract price offered.

10. The seller reciprocates to the commitment of the buyer to forego a contract price reduction and at least reduces the amount of output sold in the market when  $p_m \geq p_c$

## 7.6 Summary

This chapter proposed a buyer-seller model to examine a double moral hazard problem prevalent in African food chains. The basic model shows that while the buyers have a clear incentive to offer a contract and the seller to accept it as an insurance policy, both will shirk on their contractual commitments to maximize their gains. This first case mimics what is observed in reality. Then, a variation to this basic model withdraws the right of the buyer to change the prices offered. In this case, only the seller can breach the contract. As shown in section 6.3, in this case, the buyer still is better off proposing a contract and will not need to offer more than the expected market price. The main prediction of this model is that contracts will be offered and accepted but the seller will breach whenever the market price is larger than the contractual offer. Finally, in the case where the buyer has the option to commit to a price, it is expected that rational buyers will not exercise such an option. Consequently, we fall on the double moral hazard case described in section 7.3. On the other hand, if the buyers believe sellers tend to reciprocate to unselfish commitments and opt to offer a binding price offer, the game becomes akin to that introduced in section 7.4 where a breach is lower. The next chapter introduces an experiment designed to test the hypothesis in this model.

## CHAPTER EIGHT

### Experimental Methods

#### 8.1 Introduction

A suitable methodology to test the hypothesis derived from the model described in chapter 6 is experimental economics. Over the last three decades, this methodology emerged as a robust and rigorous way to test economic theory and concepts using computer laboratories. This is because the suitable data set for the study of the effect of the absence of third-party enforcement on contracts and strategies for enforcement is one that should allow the researcher to exogenously vary the strategies. In a study of relational contracts and market interactions, Brown *et al.* (2004) argued that it is the exogenous variation strategies that allow the researcher to make causal inferences on the impact of different degrees of enforcement strategies. It is almost impossible to find field data that suits this data set. For example, it is hardly possible to find field data that allows one to observe side-selling or contract price reduction under varying degrees of enforcement strategies in market interaction, but such is possible using experimental methods. Similarly, in a choice experiment, people may lie about their true type when examining moral hazard behaviours. In these instances, the experimental method produces superior data. These reasons justify the use of experimental methods in this study to examine different contract enforcement strategies. As discussed in the last section of chapter six, experiments have been used to investigate contract relations, and particularly close to the present study is the work by Kunte *et al.* (2016). Thus, this chapter introduces the experiment and how it was implemented. It also describes the data analysis methodology used to produce the results. The chapter is organized into 7 sections. Next, the experimental design and treatments are detailed in section 8.2. The sequence of the experiment, and experimental procedure and implementation are discussed in sections 8.3 and 8.4, respectively. Then in section 8.5, the data and analytical methods are presented. Section 8.6 discusses the empirical methods, followed by a summary of the chapter in section 8.7.

#### 8.2 Experimental treatments

To test the hypothesis in the theoretical model presented in the previous chapter, an experiment between a buyer and a seller was designed. As in the theoretical model, a buyer and seller trade a given product by using either a contract or an external market. This is a



one-shot sequential game where the buyer moves first and proposes a price per unit of a good to the seller. Note that the buyer may decide not to propose a contract to the seller. If she does not, she can buy in the exogenous market at a price  $P_m \in [1,7]$ , generated from a random discrete uniform distribution. Otherwise, the buyer can set a contract specifying a price,  $P_c$  per unit of the good which also varies between 1 and 7. The seller may or not accept the contract offer from the buyer. If there is no contract offer or if the seller rejects the contract, he can sell all units of the good produced in the market, whilst the buyer can only purchase 11 units of the good in the market at the market price,  $P_m$ . The total amount of units of goods produced,  $Q$  is also determined from a computerized random discrete uniform distribution process and  $Q \in [11,20]$ . There is asymmetric information on the quantity produced which is not contracted. Once the market price and the quantity produced are revealed to the seller, he decides whether or not to comply with the contract, deciding on whether she delivers all output to the buyer or side-sells some in the market. However, if the seller agreed to sign the contract, he must deliver a minimum of 11 units to the buyer. The buyer then observes how many units are delivered by the seller and decides the final price to pay. The buyer can reduce the contract price by up to 2 ECU. To test the hypothesis derived in the model, two further treatments are considered. In the second treatment, the buyer no longer can change the price offered in the contract. Then, the last treatment mimics the third case of the model and the buyer has an option to refrain from changing the price offered to the seller. Next, a sequence of each treatment is described in more detail.

### **8.3 Sequence of the experiment**

As described in the model in chapter 7, the experiment has three main treatments, the baseline treatment (BT) which refers to the baseline contract with double moral hazard, the enforced treatment (ET), which describes the single moral hazard contract, and the optional treatment (OT) which refers to the double moral hazard contract with optional binding. In the baseline treatment, the buyer chooses the contract price if he decides to offer a contract. If the buyer does not offer a contract, she can buy 11 units of the good in the market at the going price. Likewise, the seller sells all units produced in the market. If the buyer offers a contract and the seller does not accept it the same occurs. However, if the seller accepts the price, he must deliver a minimum of 11 units of the good to the buyer at the contract price. Then nature moves and both the market price and the quantity produced are revealed.

Observing the market price and comparing it to the contract price, the seller decides whether to deliver all the output to the buyer or just the minimum 11 units. After delivery, the buyer decides the final price to pay. Afterward, both the seller and buyer get informed about their earnings.

In the enforced treatment, the buyer after choosing the contract price exogenously forgoes the option to review it. In other words, the buyer cannot reduce the contract price ex-post. This is communicated to the seller before contract acceptance. All other decisions are identical to the baseline treatment. After the final stage of decisions, they are informed about their earnings. In the optional treatment, the buyer after choosing the contract price, endogenously selects from options whether she would like to forgo a chance to review the contract price or maintain his option to review the contract price ex-post. If the buyer chose to forego an option to review the contract price, then the contract becomes binding and she cannot reduce the contract price, akin to the enforced treatment. This results in a sub-treatment called optional enforced treatment (OET). Otherwise, she may reduce the contract price ex-post as in the baseline contract, generating a sub treatment called optional non-enforced treatment (ONET). The decision taken by the buyer is revealed to the seller before contract acceptance. All other decisions remain the same as in the baseline contract. After decisions are made, they are informed about their earnings. Figure 8. 1 below presents the stages of the experiment for the baseline treatments.

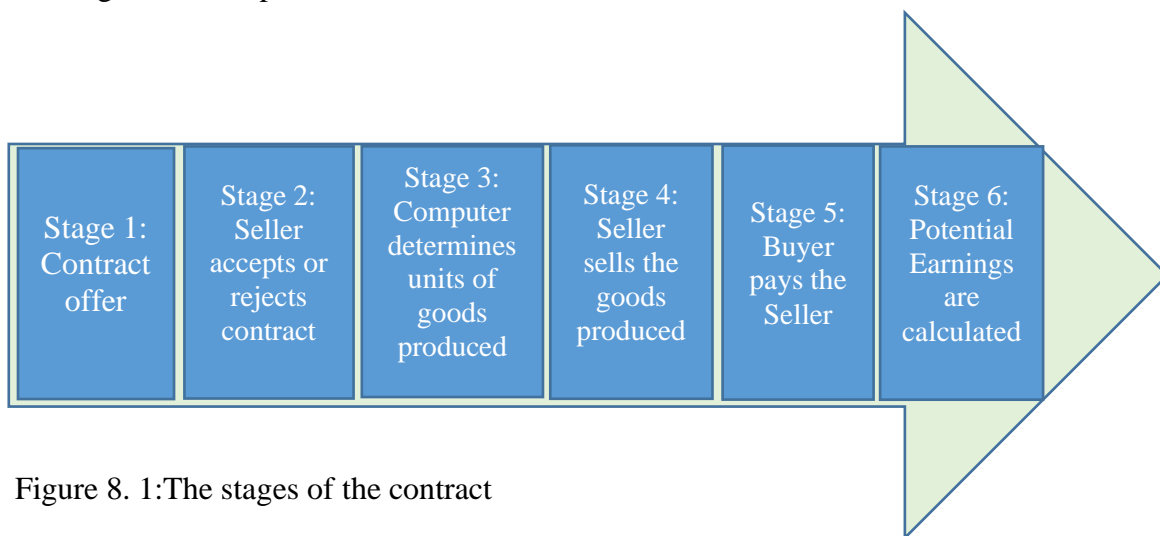


Figure 8. 1: The stages of the contract

The BT treatment will be used as the basis of comparison with the other treatments in the econometric analysis. In this treatment, both the sellers and buyers are free to shirk after they have agreed on a contract. The seller is free to deliver less than the units of a commodity produced. Also, the buyer may reduce the contract price after the seller has delivered the commodity.

#### **8.4 Experimental procedures and implementation**

The experiment was conducted in the Behavioural and Experimental North East Cluster (BENC) laboratory in Newcastle University Business School, Newcastle Upon Tyne between December 2018 and February 2019. The experiment was computerized using the software package z-tree (Fischbacher, 2007). Subjects were Newcastle university students recruited from a subject pool. The experiment used a fictionary currency, the ECU with an exchange rate of £0.2 (twenty pence) per ECU. Each session lasted for 2 hours and participants received an average payoff of £16 (about USD 21 at the time of implementation) including a show-up fee of £3.

Upon arrival, students received the experiment's written instructions and were randomly assigned to their computer booths. The experimental instructions were then read aloud to them through recorded audio. Subsequently, every participant answered questions to prove their full comprehension of the instructions. Facilitators were on hand to assist with individual queries. Once all subjects completed answering questions based on the experimental instructions the experiment started. Each session had 12 rounds. The first two rounds were practice and did not count towards the players' earnings. The purpose of the practice round was to deepen participants' understanding of the decisions involved in the experiment and the consequences of each decision. Once all subjects have concluded the experiment, they answered a post-experimental questionnaire soliciting their demographics after which they received their cash payment.

As reported in Table 8.1 below, 15 experimental sessions were run. In each baseline treatment session, there were 20 participants except in one session where there were 18 participants. In the enforced treatment, 20 participants attended each session.

Table 8. 1: The Treatments and number of participants

	<b>Treatment 1</b>	<b>Treatment 2</b>	<b>Treatment 3</b>
	<b>(Baseline treatment)</b>	<b>(Enforced treatment)</b>	<b>(Optional treatment)</b>
<b>Sessions</b>	4	4	7
<b>Number of participants</b>	78	80	136

The optional treatment had 20 participants attending all but two sessions. The two sessions were attended by 18 subjects. Therefore, a total of 294 subjects participated in the experiment with nobody attending more than a session. Given each session had 10 rounds and there were equal numbers of buyers and sellers, with between-subject design and stranger matching protocol we obtained 390 independent observations in the baseline treatment, 400 in the enforced treatment, and 680 in the optional treatment.

## 8.5 Data and analysis

The software on which the experiment was programmed records all the decisions for each of the participants in each session of the three treatments and the answers to the survey on participants' socio-demographics and beliefs. The data analysis was done in three stages. First, to have an overall perspective of the data compiled, descriptive statistics and graphs were generated to aid an understanding of the level of quality of the data and have an initial idea on conjectures in the model. Then, to test treatment effects, non-parametric tests were employed to investigate whether significant differences exist in the proportion of buyers and sellers breach as well as on other variables of interest. Finally, the panel Tobit model was used to further investigate the determinants of seller breach. Next the dependent and independent variables in our dataset are described.

### 8.5.1 Data

The experiment generated a substantial amount of data. Specifically, data on subjects' actions, prices, and quantities as well as subjects' socio-demographic profiles and beliefs were collected for all three treatments of the experiment. Data on buyer's action collected included contract offer, contract price, decision to forgo the right to review contract price, in the case of the optional treatment, belief about whether the seller delivered exactly the quantity of the commodity produced, and finally, contract price reductions. Turning to the seller's actions, data collected comprises contract acceptance if the buyer offered a contract and side-selling. Other data collected included the quantity of the commodity produced, the spot market price, and the final profit for buyers and sellers. The socio-economic profiles of subjects collected were the gender, age, area of study, whether a subject was a student, and whether a subject studied economics.

### 8.5.2 Tobit model specification

The researcher is interested in understanding whether the buyer and seller breach the contract in the different treatments and what may explain this behaviour. There are two ways of investigating these decisions. First, a binary dependent variable, which takes the value of 1 if either the buyer or the seller breaches the contract and 0 otherwise. Since this is a binary dependent variable either Logit or a Probit model could be used. Alternatively, the amount of output the seller side sells and how much (if at all) the buyer reduces the contract price as a measure of contract breach. In this case, the data has a censored dependent variable as a zero amount of quantity breach or price reduction could have different interpretations. Since the dependent variables are censored and observations involve over 10 periods for each participant and independence between the individual effect and the regressors could be assumed, a suitable econometric approach to investigate the contract breach is the Tobit random-effects model.

The Tobit random effects model is generally specified as (Greene, 2007; Wooldridge, 2010)

$$y_{it}^* = \beta X'_{it} + e_{it} \quad (13)$$

$$y_{it} = \begin{cases} \beta X'_{it} + e_{it} & \text{if } y_{it}^* > a \\ a & \text{if } y_{it}^* \leq a \end{cases} \quad (14)$$

Where  $X'$  is a vector of regressors and  $\beta$  is a vector of parameter coefficients to be estimated and  $e$  a vector of disturbances, which is assumed to follow a normal distribution with mean zero and variance  $\sigma_e^2$ . The subscript  $i = 1 \dots N$  identifies the subjects in our experiment, whereas  $t=1 \dots 10$  denotes the period.

## 8.6 Empirical estimation

Following section 7.3.2 the model is estimated using the amount of output sold by the seller in the market (side-selling), which varies between 0 and 9. This is the measure of the seller's contract breach. This dependent variable is regressed on the treatment variables (modeled as dummy variables), market price, and socio-demographic variables as described in Table 8.2. The model is estimated in STATA (version 15) through maximum likelihood.

### 8.6.1 Empirical model specification and description of variables

$$SS = \beta_0 + \beta_1 GENDER + \beta_2 ECONS + \beta_3 UNITSX + \beta_4 PCPSM + \beta_5 PERIODLAG + \beta_6 ET + \beta_7 OT + \beta_8 ETxPCPSM + \beta_9 OTxPCPSM + \sigma, \quad (15)$$

where  $SS$  = the dependent variable. This refers to the units of commodity side-sold by the seller in the market.

$\beta_1 - \beta_9$  = regression coefficients of the independent variables which are to be estimated.

$\beta_0$  = the intercept

Variables used in the panel regression include side-selling ( $SS$ ) as the dependent variable. The treatments include the baseline, the enforced, and the optional treatments as shown in Table 8.2. Other variables used include contract price-market price difference ( $pcpsm$ ) as well as the interaction between  $pcpsm$  and treatments. Units of the commodity produced and a lagged variable of the period of the contract (which captures the notion of experience encountered in a previous contract) were also included in the model. Other socio-economic variables considered included gender and whether a participant is an economist.

Table 8. 2: Summary description of variables in the empirical and expectations

<i>Variable</i>	<i>Description</i>	<i>Measurement</i>	<i>Expected sign (+/-)</i>
ET	Enforced treatment	A dummy variable. The buyer by a default forgoes his option to review contract price	A negative relationship is expected between this treatment and seller contract breach
OT	Optional treatment	A dummy variable. Measured as whether or not a buyer decides to voluntarily forgo her right to review the contract price	A negative relationship is expected between the treatment and seller breach if the buyer voluntarily forgoes his right to review the contract price, otherwise, a positive relationship is expected
ECP	Enforced contract price.	A dummy variable. (1=enforced contract price, 0 otherwise).	A negative relationship is expected between the variable and seller breach
PCPSM	Contract-spot market price difference	A discrete variable. Measured as a contract price minus spot market price	A positive relationship is expected if PCPSM is negative and negative relationship expected is PCPSM is positive
ETxPCPSM	Interaction variable	Interaction between the enforced treatment and PCPSM	Expectation is treatment would cancel out the effect of a higher market price. Therefore, a negative relationship is expected.
OTxPCPSM	Interaction variable	Interaction between optional deposit and PCPSM	A negative relationship is expected if the buyer voluntarily forgoes the right to review price, otherwise a positive relationship.
UNITSX	Units of commodity	A discrete variable. Number of units of commodity produced	Seller is expected to side-sell the higher the number of units produced
PERIODLAG	A lag variable of period of contract	Denote an experience from previous contract	A seller with a previous experience of breach by buyer may side-sell
GENDER	Either a seller is a male or female	Dummy (MALE= 1, 0 otherwise)	+/-
ECONS	Whether or not a seller is an economic student	Dummy (ECONS = 1, 0 otherwise)	-

Recall from the model that the experimental treatments can be grouped into two based on whether contract price can be reviewed ex-post, the enforced contract price, and the non-enforced contract price. The enforced contract price comprises both the enforced treatment and optional enforced treatment. The non-enforced contract price consists of the baseline treatment and the optional non-enforced treatment. The enforced contract price denoted ECP is considered a variable in the regression analysis.

## **8.7 Summary**

This chapter describes the most appropriate method for investigating moral hazard in a buyer-seller contract, which has been a preferred approach for testing contract theory in recent literature. It describes the three experimental treatments; the baseline, the enforced, and optional treatments, necessary to test the hypotheses derived in the model and the sequence in which the buyer and the seller make choices in the experiment. The experimental procedure and implementation describing, first the location and participants and next, experimental sessions implemented in each treatment and observations of each treatment are detailed. Finally, the chapter concludes by describing the data collected and the suitable analytical techniques for analyzing the data to generate results. In the chapter that follows, the results of the analysis are presented.



## CHAPTER NINE

### **Results from an Experiment on the Mitigation of Double Moral Hazard**

#### **9.1 Introduction**

This chapter presents the results of the experimental investigation of double moral hazard in contracts. First, the sample for the experiment is described in sections 9.2. The results of the proportions of contracts offered and accepted or rejected are shown in section 9.3. This section starts with descriptive statistics and follows with a non-parametric test for differences across treatments. Next, section 9.4 presents the results for the contract prices offered and accepted as well as the units of output delivered. Again, the section starts with descriptive statistics followed by non-parametric tests. Section 9.5 shows the results of contract breach and mitigation measures. It contains 2 sub-sections, first, it presents the results on the investigation of side-selling or seller's moral hazard and then contracts price reduction by buyer. Each of these sections comprises a descriptive analysis, results from non-parametric tests, and finally, the results from Tobit panel regressions with random effects. In section 9.6 the results on whether contract breach is profitable are presented. Finally, section 9.7 summarizes the chapter.

#### **9.2 The sample of the experiment**

The experiment consisted of three treatments: namely the baseline treatment (BT), the enforced treatment (ET), and the optional treatment (OT). Further, the optional treatment had two variations; the optional enforced treatment (OET) denoting a sub-treatment if the buyer, after making a contract offer, decided to forego his right to review the contract price ex-post. This sub-treatment was akin to the enforced treatment, in which contract price is binding. Alternatively, if the buyer voluntarily decided to retain his right to review price ex-post, the ensuing sub-treatment was denoted as an optional non-enforced treatment (ONET) akin to the baseline treatment, in which the buyer and seller could both breach the contract. A total of 294 subjects participated in the experiment, in proportions of 78, 80, and 136 in the baseline treatment, enforced treatment, and the optional treatment, respectively. A total of 390 observations were made in the baseline treatment, 400 in the enforced treatment, and 680 in the optional treatment, resulting in an overall 1,470 observations. A decision from a player in a round of the experiment constitutes an observation. Since there were two players, a buyer, and a seller, interacting in a round, each

round had two observations. Therefore, for example, 10 players interacting for 10 periods in a session generated 100 observations and 400 observations in 4 sessions.

### 9.3 Contract offered and accepted

This section presents descriptive statistics of the proportion of buyers who made a contract offer and the proportion of sellers who accepted the contract offer. It also presents a non-parametric test of the effect of treatments on the proportion of contracts offered and accepted.

#### 9.3.1 Descriptive statistics

Figure 9.1 shows the proportion of buyers who offered a contract and sellers who accepted a contract if an offer was received in each of the experimental treatments.

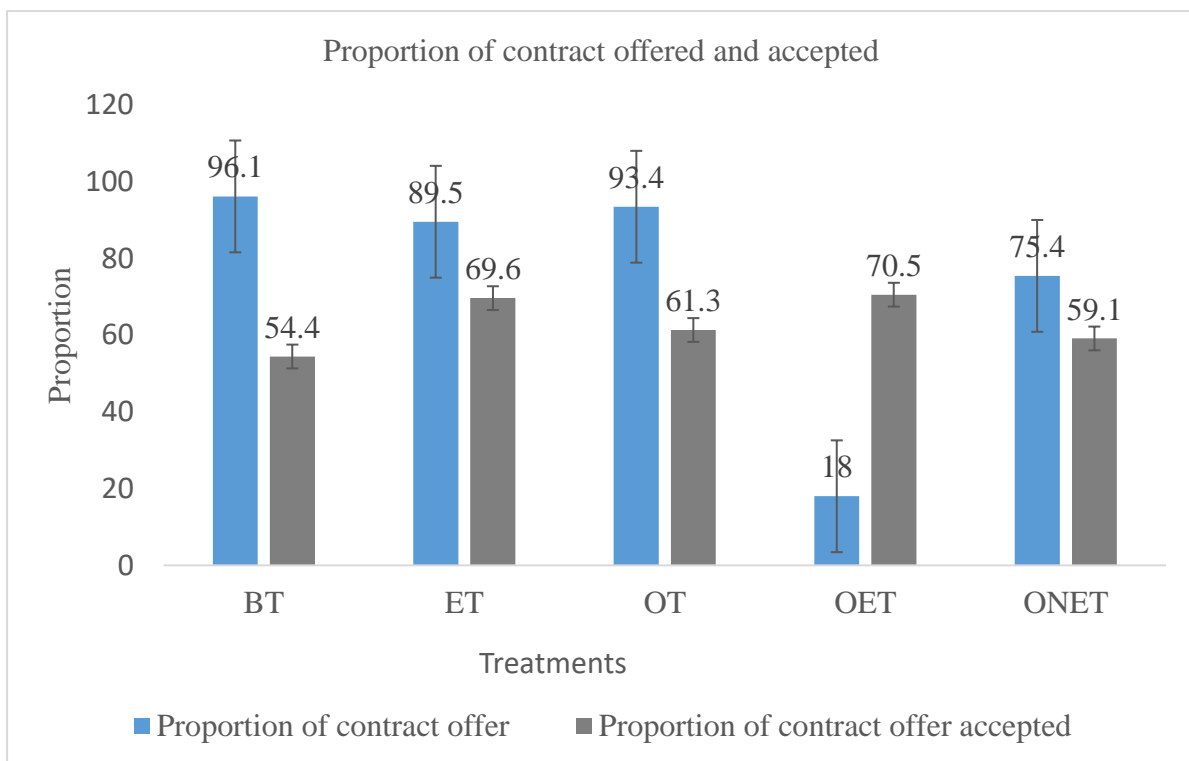


Figure 9. 1:Proportion of contract offered by buyers and the proportion of offers accepted by sellers

About 96.1% of contract offers were made in the baseline treatment, 89.5% in the enforced treatment, and 93.4% in the optional treatment. This means in the baseline treatment, 3.9% of buyers did not make contract offers and preferred to trade in the spot market. Similarly, in the enforced treatment and the optional treatment, 10.5% and 6.6% of buyers respectively, chose to trade in the spot market rather than use a contract. Splitting the optional treatment into the sub-treatments and observing proportions of contract offers, it was found that 18% of contract offers involved a voluntary decision to forgo the right to review price ex-post, whereas 75.4% of offers involved a voluntary decision to maintain the right to review price (i.e. 18% contract offers were made in the optional enforced treatment and 75.4% were made in the optional non-enforced treatment). Turning to contract acceptance decision, 54.4% of contract offers were accepted in the baseline treatment, 69.6% were accepted in the enforced treatment and 61.3% accepted in the optional treatment. Within the optional treatment, 70.5% of offers were accepted when the buyer voluntarily decided to forgo his right to review the contract price ex-post, but 18% of offers were accepted when the buyer decided to retain his right to review the price ex-post.

### 9.3.2 Non-parametric test for treatments effect

The following non-parametric tests examine the differences between the treatments for their effect on the proportion of contract offered and contract accepted. It identifies whether there is a significant difference in the proportions of contract offers between the baseline treatment and the other treatments. Table 9.1 presents a Two-Sample Wilcoxon rank-sum tests for the treatment effects.

Table 9. 1:Two Sample Wilcoxon rank-sum tests for treatment effects on contract offered and contract accepted.

<b>Treatment</b>	<b>Contract offered</b>	<b>Contract accepted</b>
BT vs ET	0.02**	0.02**
BT vs OT	0.56	0.18
OET vs ONET		0.08*

A Two Sample Wilcoxon rank-sum tests are performed at sessional level. \*\*\* (\*\*) [\*] Significance at 1% (5%) [10%] level.

The test shows a significant difference in the proportion of contract offers in the baseline treatment compared with the enforced treatment, indicating that buyers made significantly more contract offers in the baseline treatment. Regarding, the optional treatment, the test shows no significant difference in the proportion of contract offers. Thus, contract offers in the optional treatment and the baseline treatment are not different. Now, turning to the proportion of contract accepted, the test shows a significant difference between the baseline and the enforced treatments. Significantly higher proportions of offers were accepted in the enforced treatment. A noteworthy observation is that while contract offers were low in the enforced treatment compared with the baseline, contracts accepted were higher in the enforced. Observing voluntary decisions in the optional treatment, the results indicate a significantly higher proportion of contracts accepted if the offer involved a decision to forego the right to review price in comparison with retaining the right. These results provide preliminary evidence that a binding contract price (as observed in the enforced treatment and the optional enforced treatment) leads to increased contract acceptance by sellers. Nonetheless, the results suggest buyers have a higher preference for a non-binding contract (as observed in the baseline and the optional non-enforced treatments).

#### **9.4 Contract price offered and price accepted**

In this section, descriptive statistics of the contract price that was offered by buyers and the price accepted by sellers are shown. Also, differences in treatments with regards to the price offered and price accepted are examined through a non-parametric test.

##### **9.4.1 Descriptive statistics**

Results on contract price offered by the buyer and the price accepted by the seller, in each of the three treatments are presented. According to hypotheses 1 and 4 derived from the model in chapter seven, a buyer would offer a contract price of 5.5 in the baseline and a price of 3.5, equal to the expected market price, in the enforced treatment. In the optional treatment, the conjecture was that a price of 5.5 would be offered if the buyer decides to retain his right to review the contract price ex-post (in the optional non-enforced treatment), otherwise a price equivalent to the expected market price would be offered (in the optional enforced treatment). Table 9.2 presents the actual prices offered and compares them with

the expected prices predicted by the hypotheses. It also compares the actual prices accepted by the seller and the predicted.

Table 9. 2: Expected price vs actual price

<b>Treatments</b>	<b>Price offer</b>		<b>Price accepted</b>	
	Expected price to offer	Actual price offered	Expected price to accept	Actual price accepted
BT	5.5	5.1	5.5	5.5
ET	3.5	4.2	3.5	4.7
OET	3.5	4.2	3.5	4.7
ONET	5.5	4.7	5.5	5.2

In the optional treatment, a price of 4.2 was offered when the buyer decided to voluntarily forgo his right to review price ex-post (optional enforced treatment) whereas 4.7 was offered when the right to review the price was retained (optional non-enforced treatment). An offer of 5.1 in the baseline treatment (BT) or 4.7 in the optional non-enforced treatment (ONET) falls short of the prediction of the hypothesis. In contrast, in the enforced treatment (ET) and the optional enforced treatment (OET), the offers (4.2) were in line with the predictions of the hypotheses.

The seller only accepts a contract if the buyer offered at least 5.5 in the baseline treatment and the optional non-enforced treatment according to the hypotheses. In the enforced treatment or the optional enforced treatment, the hypothesis proposed that a price of 3.5 would be accepted. As shown in the Table, a price of 5.5 was accepted by sellers in the baseline in line with the hypothesis. In contrast with the prediction of the hypothesis, sellers tended to accept a higher price of 4.7 in the enforced treatment and the optional enforced treatment. A lower price of 5.2 than was predicted by the hypothesis was also accepted in the optional non-enforced treatment. Regardless, the price offered and accepted in the baseline and the optional non-enforced were higher compared to that of the enforced treatment and the optional enforced treatment. In the following, the significance of the differences in price offered and accepted are examined.

### 9.4.2 Non-parametric test between treatments

In the following, a non-parametric test is applied to examine the effect of the treatments on the price offered by the buyer and the price accepted by the seller. From the hypothesis, a lower price is expected in the enforced treatment compared with the baseline and in the optional enforced compared with the optional non-enforced treatments. There should be no significant difference in the price offered in the baseline and the optional non-enforced treatments. Similarly, no difference is expected between the enforced and optional enforced treatments. Table 9.3 presents a Two-Sample Wilcoxon rank-sum tests for the treatment effects.

Table 9. 3: Two-Sample Wilcoxon rank-sum tests for treatment effects on contract price offered and contract price accepted.

<b>Treatment</b>	Contract price offered by buyer	Contract price accepted by the seller
BT vs ET	0.02**	0.02**
BT vs OT	0.06*	0.03*
OET vs ONET	0.18	0.06*

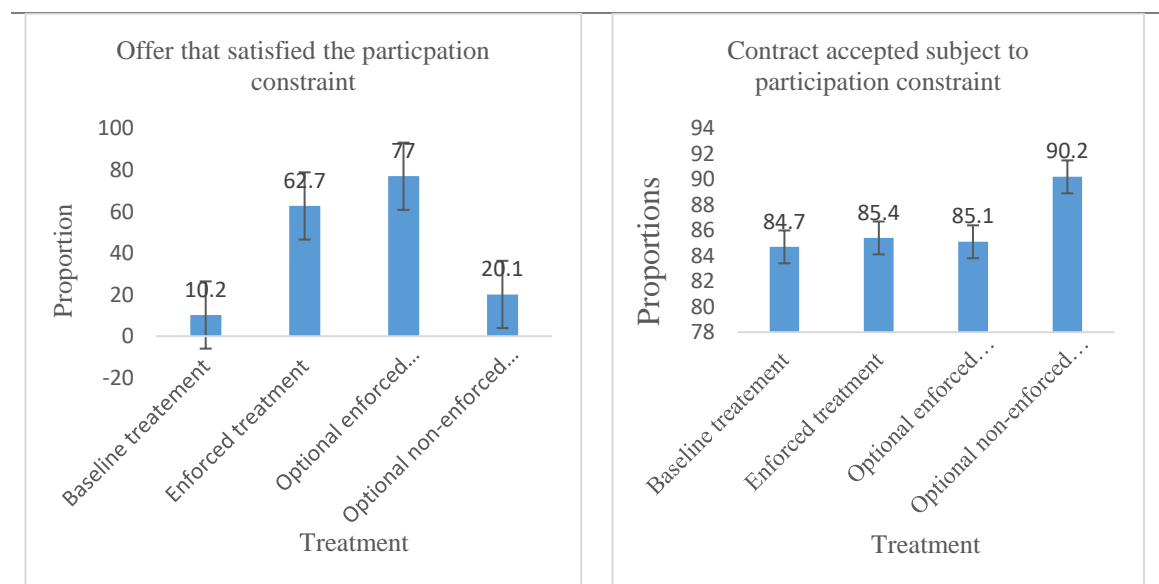
A Two Sample Wilcoxon rank-sum tests are performed at sessional level. \*\*\* (\*\*) [\*] Significance at 1% (5%) [10%] level.

The price offered in the baseline was significantly higher compared with the price offered in the enforced treatment and the optional treatment, even though the offer was lower than the prediction of the hypothesis. The test showed no significant difference between prices offered in the optional enforced and the optional non-enforced treatments, contradicting the proposition of the hypothesis. On the seller's decision, the price accepted was significantly lower in the enforced treatment compared with the baseline treatment. Similarly, a lower price was accepted in the optional treatment compared with the baseline treatment. These results are confirmed by observing decision making in the optional enforced treatment and the optional non-enforced treatment. In the optional enforced treatment, involving a forgone right to review price, a significantly lower contract price was accepted compared with the optional non-enforced treatment where the buyer retained the right to review price. Importantly, the results point to preliminary evidence of reciprocity, both positive and negative as well as the effectiveness of a mechanism that externally enforces contract price. First, on reciprocity, it is observed that in the optional treatment the seller accepted a lower

contract price from the buyer. Reciprocity is reinforced and demonstrated by observing the sub-treatments of the optional treatment. When a buyer voluntarily let go of his right to review price ex-post (in the optional enforced treatment), the seller reciprocated by accepting a lower price. In contrast, the seller reacted to the buyer's unwillingness to forgo the right to review price (optional-non enforced treatment) by accepting a higher price. On a mechanism that externally enforces contract price (such as an institution that takes a deposit from the buyer equal to the expected revenue from the sales of the commodity, which is discussed in detail in section 9.5), it is observed that when contract price was exogenously enforced in the enforced treatment, thereby eliminating buyer's moral hazard, sellers accepted a lower price.

### 9.4.3 Proportion of contract offers that satisfied the participation constraint.

The following examines the proportion of contract offers that satisfied the participation constraint and whether the seller considered the participation constraint in accepting a contract offer. According to hypotheses 2 and 5, the seller will accept a contract if the participation constraint was satisfied, hence the buyer makes an offer that meets the participation constraint. Figure 9.2 displays the proportion of offers that satisfied the participation constraint.



a. An offer that satisfied the participation constraint      b. Contract accepted subject to participation

Figure 9. 2: Proportions of the contract offered that satisfied the participation constraint and contract accepted that satisfied the participation constraint.

The results show that limited proportions of offers, 10.2%, and 20.1%, satisfied the participation constraint in the baseline treatment and the optional non-enforced treatment, respectively. In contrast, higher proportions of offers, involving 62.7% and 77.0% in the enforced treatment and the optional enforced treatments respectively, satisfied the participation constraint. Regarding contract offers accepted, the proportions were high in all treatments when respective participation constraints were met. It included 84.7% in the baseline, 85.4% in the enforced deposit, 90.2% in the optional non-enforced treatment, and 85.1% in the optional enforced treatment. This shows sellers considered their participation constraint in accepting a contract offer. Buyers, on the other hand, did not consider sellers' participation constraint in making offers, particularly, in the baseline and the optional non-enforced treatments.

Again, from hypotheses 2 and 5, a contract offer will be rejected if it does not meet the participation constraint. Figure 9.3 shows the proportions of contracts accepted when offers did not satisfy the participation constraint.

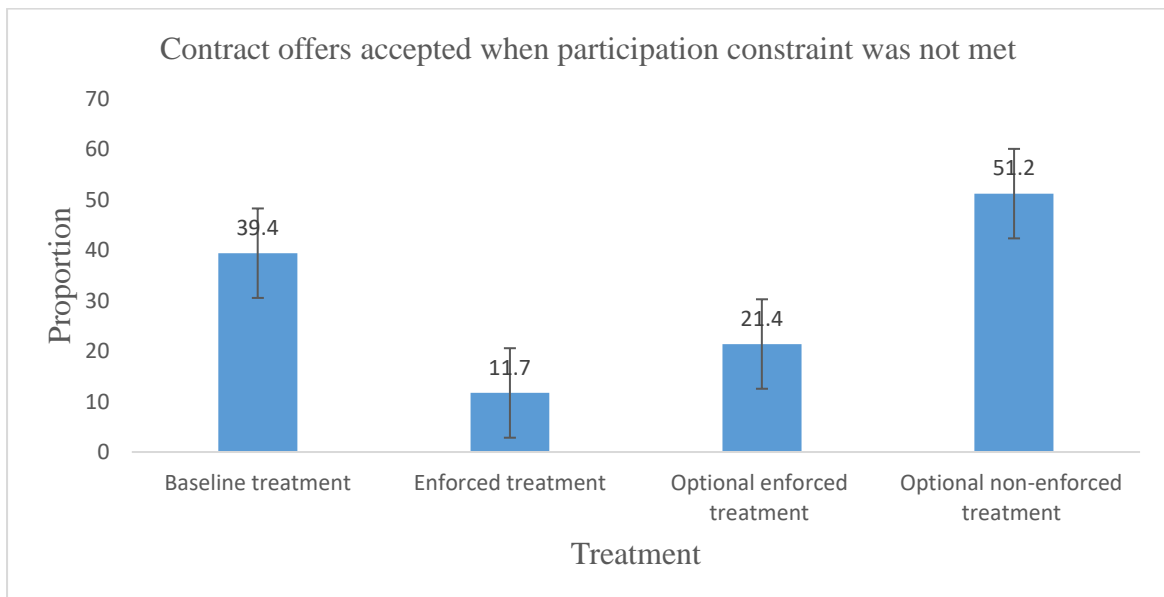


Figure 9. 3: Contract offers accepted when participation constraint was not met.



It included 39.4% in the baseline and 11.7% in the enforced treatment. In the optional non-enforced and optional enforced treatments, the proportions were 51.2% and 21.4% respectively. The results show that a higher proportion of contract offers were accepted in the optional non-enforced treatment when the participation constraint was not met, contrary to the hypothesis. Similarly, the proportion of accepted contracts in the baseline may be regarded as high and unexpected considering that the participation constraint is not met, and the offered price could be reduced further ex-post.

In concluding this section, the following are worth emphasizing. First, not many offers in the baseline and the optional non-enforced treatments satisfied the participation constraint in comparison with the enforced and optional enforced treatments. Second, in terms of rejection when the participation constraint was not satisfied, lower proportions were rejected in the baseline and the optional non-enforced treatments.

## **9.5 Contract breach**

The experiment examined double moral hazard, that is, side-selling of a contracted commodity by sellers and ex-post contract price reduction by buyers. First, the results on side-selling are presented, and next the results on price reductions by buyers.

### **9.5.1 Side-selling**

This section presents descriptive statistics of side-selling. Again, it employs a non-parametric test to examine the treatment effect on side-selling.

#### **9.5.1.1 Descriptive statistics**

Descriptive statistics of side-selling are presented in this section. Further, the section examines partial side-selling by comparing units of the commodities that were side-sold with units available that were available for side-selling. In the experiment, a seller is free to side-sell every unit of the commodity above the minimum delivery quantity, meaning a seller may have up to 9 units of the commodity to side-sell. A partial side-selling occurs if

the units of commodity side-sold were less than the available units that could have been sold. Also, the results examine side-selling when the market price exceeded the contract price. According to hypotheses 3 and 6, a seller will side-sell whenever the market price is higher than the contract price. As shown in Figure 9.4, side-selling was 2.4 units in the baseline treatment, 1.7 units in the enforced treatment, and 2.3 in the optional treatment. In the optional treatment, side-selling was 1.7 when the buyer decided to forgo the right to review price, but 2.4 units when the right to review price was retained.

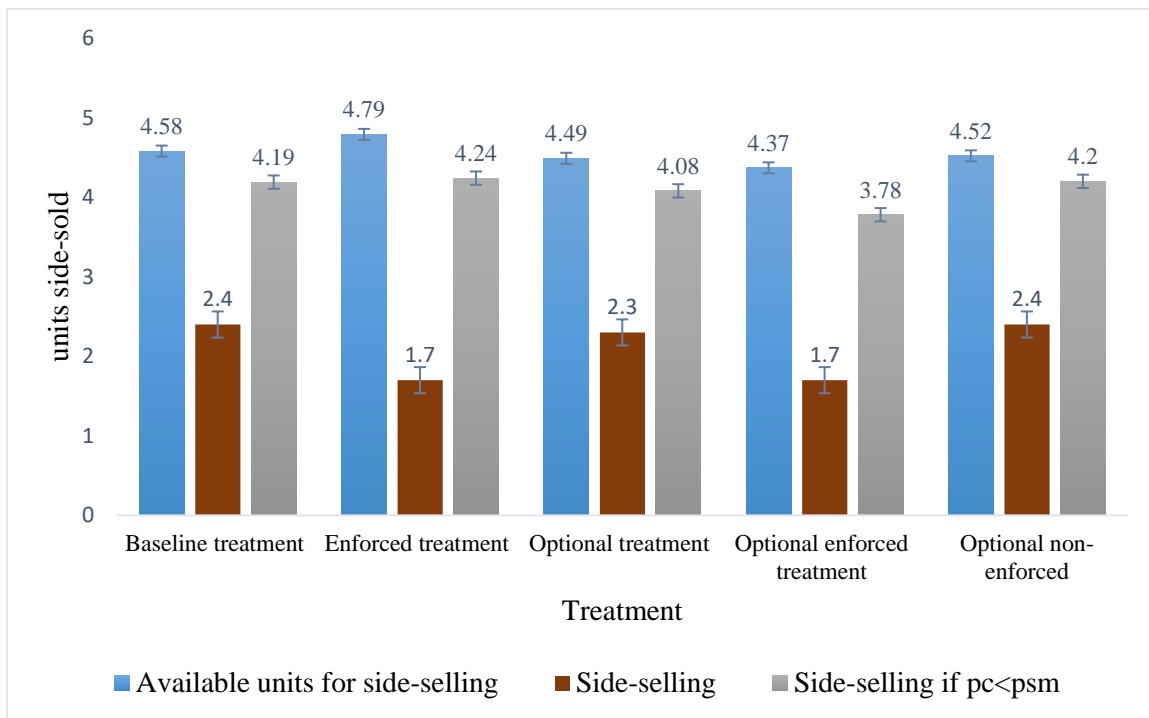


Figure 9. 4: Units of commodity side-sell as a share of units available for side-selling

Available units of the commodity that could be side-sold were 4.58 in the baseline treatment, 4.79 in the enforced treatment, and 4.49 in the optional treatment. 4.37 units and 4.52 were available for side-selling in the optional enforced and optional non-enforced treatments, respectively. Comparing side-selling to available units reveals incidences of partial side-selling in all treatments. Normally, the expectation is that a higher number of units available would result in more side-selling, holding other factors constant. As the results show, the enforced treatment had the highest units available. Contrarily to expectation, however, side-selling turned out to be lowest in the enforced treatment. Side-selling when the market price exceeded contract price was 4.19 in the baseline, 4.24 in the

enforced treatment, and 5.08 in the optional treatment. In the optional enforced treatment side-selling was 3.78 and 4.20 in the optional non-enforced treatment.

### 9.5.1.2 Non-parametric test

This section investigates treatment effects on side-selling by applying a non-parametric test. From the hypothesis, side-selling is not expected to differ between the baseline and the other treatments. As shown in Table 9.4, first the test showed no significant difference between treatments regarding the number of units available for side-selling, implying treatment effect is not attributable to differences in the number of units available to a treatment. Secondly, the test showed side-selling is significantly reduced in the enforced treatment, but not the optional treatment, compared with the baseline. Thus, enforced treatment had a significant effect on side-selling.

Table 9. 4: A Two-Sample Wilcoxon rank-sum test for side-selling

Contract type	Units available to side-sell	Side-selling	Side-selling pc<psm
BT vs ET	0.77	0.04**	1.00
BT vs OT	0.57	0.70	1.00
OET vs ONET	0.33	0.33	0.56

A Two Sample Wilcoxon rank-sum tests are performed at sessional level. \*\*\* (\*\*) [\*] Significance at 1% (5%) [10%] level.

The results establish preliminary evidence of the effectiveness of external enforcement of contract price on mitigating side-selling. In the following analysis, a more rigorous analytical technique is employed to examine the treatment effect on side-selling.

### 9.5.1.3 Tobit regression

This section presents the results of a random-effects Tobit regressions analysis of side-selling with data from all three experimental treatments. In the regression, dummy variables were used for the experimental treatments. Other variables considered include contract price-market price difference (pcpsm), enforced contract price (ECP), units of the commodity produced, and experience in the previous contract, measured as period lagged.

Though the experiment was one shot, meaning a buyer and a seller interacted only once, it is possible a player's behaviour in subsequent periods of the contract with another player could be impacted by his experience in the former contract. Hence the introduction of the variable, period lagged to observe the effect of contract experience on side-selling. Interaction variables between pcpsm and the treatments were also used to capture any interaction effects between price and treatments on side-selling. Finally, other socio-economic variables including gender and whether the subject is an economics student were considered, as dummy variables. The results are shown in Table 9.5.

Table 9. 5: Tobit regression of side-selling

Dep. Var: Side-selling	Model 1	Model 2	Model 3	Model 4
ECP	-2.989*** (0.343)			
ET		-3.349*** (0.5018)	-3.354*** (0.5015)	-3.662*** (0.515)
OT		-0.869** (0.432)	-0.864** (0.432)	-0.975** (0.435)
Pcpsm	-1.778*** (0.082)	-1.752*** (0.826)	-1.751*** (0.082)	-1.789*** (0.148)
Units produced	0.913*** (0.053)	0.915*** (0.541)	0.967*** (0.054)	0.918*** (0.053)
Economics	0.110 (0.376)	0.469 (0.360)	0.050 (0.385)	0.096 (0.379)
Gender	0.572* (0.343)	0.600* (0.352)	0.599* (0.352)	0.588* (0.345)
Period Lagged			0.026 (0.048)	
ED x Pcpsm				-0.576*** (0.226)
OD x Pcpsm				0.292* (0.171)
Constant	-11.72*** (0.906)	-11.55*** (0.960)	-11.73*** (1.011)	-11.58*** (0.958)
Observation	842	842	842	842
Prob > X <sup>2</sup>	0.000	0.000	0.000	0.000
Wald > X <sup>2</sup>	598.7	574.2	574.5	584.2
Left-censored	455	455	455	455
Right-censored	38	38	38	38
Uncensored	349	349	349	349

NB: The Table shows Tobit regressions. \* Significance at 10%, \*\* significance at 5%, \*\*\* significance at 1%; standard errors are in parenthesis.

Model 1 examines the effect of the enforced contract price (ECP) on side-selling. The coefficients of ECP, units produced and pcpsm are significant. Gender is, however, weakly significant. The negative effect of ECP on side-selling indicates that a binding contract price reduced side-selling by 2.9 units compared when the price is non-binding. The impact of pcpsm is negative as expected, indicating that a unit increase in contract price above the market price results in a 1.8 decrease in side-selling. Units of the commodity produced, on the other hand, have a positive effect on side-selling, implying a unit increase in the number of units of the commodity produced results in 0.9 units increase in side-selling. Model 2 focuses on examining the treatment effect, that is, the effect of the enforced treatment (ET) and the optional treatment (OT) on side-selling. According to hypothesis 10 in the model, the seller will reciprocate if the buyer forgoes the right to review price through a decreased side-selling. The results showed a significant treatment effect on side-selling. In the enforced treatment, side-selling was 3.7 units lower compared with the baseline treatment. Similarly, in the optional treatment side-selling was 0.96 units lower in comparison with the baseline. These results are in line with the prediction of the hypothesis that the seller will reciprocate the commitment of the buyer to forgo his right to review the contract price. These results reinforce the non-parametric tests. The contrast, however, is that whereas side-selling in the optional treatment was not significantly different from side-selling in the baseline with the non-parametric test, the regression results showed a significant difference, though the value of the coefficient is small.

It can be recalled from the descriptive statistics that a lower proportion of buyers decided to forgo their right to review price in the optional treatment. Therefore, the treatment contains a lower incidence of buyers forgoing their right to review price, and that possibly accounted for the lower value of the coefficient. Though the coefficient of period lagged is positive, suggesting that experience from previous trade has a positive relationship with side-selling (as shown in model 3), the result is not significant. In model 4, interactions between pcpsmxET and pcpsmxOT are considered. PcpsmxET is significant and negatively affects side-selling as expected. Contrarily to expectation pcpsmxOT has a significantly positive impact on side-selling. Recall that in the optional treatment significantly larger number of buyers declined to forgo their right to review contract price. Therefore, there was a high number of observations with the characteristic of the baseline treatment (the optional non-enforce treatment). To offset the impact of a negative pcpsm,

however, requires a strong treatment effect, which is limited in the optional treatment due to many observations akin to the baseline treatment. This possibly explains the reverse impact when optional treatment interacted with the contract price.

In summary, the results of the regression analysis provide additional evidence that side-selling is reduced when the buyer is forced to respect the contract offer. First, the results have shown evidence of reciprocity. There was a significant reduction in side-selling in the optional treatment which involves a voluntary buyer decision to forego the right to review price. Secondly, there is a strong confirmation for the effectiveness of a mechanism that externally enforces contract price on mitigating side-selling as evident in the strong negative effect of the enforced treatment on side-selling.

### 9.5.2 Contract price reductions by the buyer

This section presents descriptive statistics of price reductions in the baseline treatment and the optional non-enforced treatment. Recall that the buyer is free to reduce the contract price by 2 after the seller has delivered the commodity and the hypothesis is that the buyer will reduce the price by the maximum amount of 2. By the experimental design, the price reduction is not applicable in the enforced treatment and the optional enforced treatment since the price is enforced. Next, a result of a non-parametric test examining significant differences between the treatments is presented. Further, the section examines buyer's beliefs about side-selling and how that influences price reduction by the buyer.

#### 9.5.2.1 Descriptive statistics

The following descriptive statistics in Table 9.6 shows the extent of price reductions by buyer. In the baseline treatment, the buyer reduced the contract price by 1.79. In the optional non-enforced treatment price was reduced by 1.72.

Table 9. 6: Price reductions

Contract type	Price reductions	Price reduction B relative to belief	Price reduction A relative to belief
BT	1.79	1.83	1.85
ONET	1.72	1.96	1.83

Both results suggest a partial price reduction, thus, buyers did not always reduce the price by the maximum amount, contrary to the hypothesis. A non-parametric test showed that there was no significant difference in price reduction between the baseline and the optional non-enforced treatment.

The price reduction per period in concluded contracts is shown in Figure 9.5. In both optional treatment and optional non-enforced treatments, the price reduction was minimal in the first period but increased sharply in the second period. A general increasing trend in price reduction was observed though with ups and downs. As noted in the next chapter, this observed trend is important in explaining behaviour in contract price reduction.

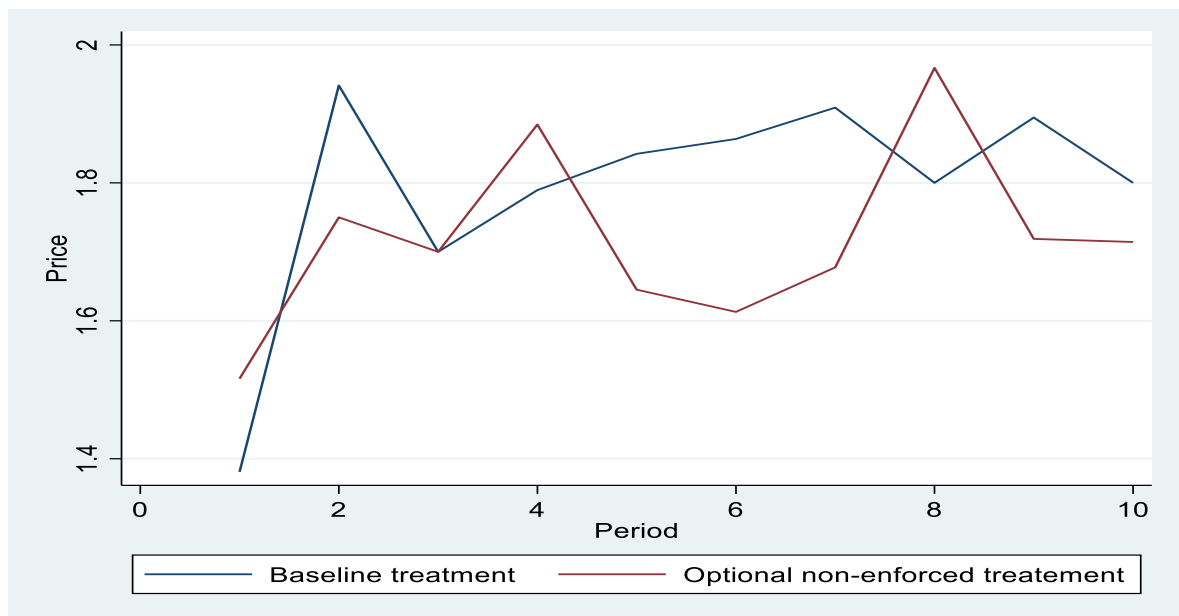


Figure 9. 5: Price reduction per period

### 9.5.2.2 Belief and price reduction

People exhibit considerable reciprocity by reacting to a negative action with equally negative action and positive action with positive behaviour. Reciprocity could be intention-based, that is trying to read the other's mind and responding to what is believed to be their intention. Therefore, in the experiment, a buyer's behaviour can be a response to her belief of the expected behaviour of the seller, if behaviour is not observed. To obtain insight into what drives behaviour of buyers (price reduction) the experiment elicited the buyer's belief

about units of the commodity produced. If units stated by the buyer is equal to units delivered by the seller, then the buyer believes no side-selling occurred and vice versa. A buyer receives a bonus of 10 experimental currency units if her belief statement is correct. Half of the belief elicitation occurred before the buyers decided on the price reduction and were termed price reduction B. The other half was elicited after the decision on price reduction has already been made and termed price reduction A. From hypothesis 8, a buyer will reduce the contract price ex-post even if he believes the seller delivered all the commodity produced. The results of the analysis are shown in Table 9.6. In both treatments, the price reduction was higher when the stated belief was correct, meaning even when buyers believed there was no side-selling they tended to reduce the price. In the baseline treatment, price reduction B was 1.83 and 1.85 in price reduction A. In the optional enforce treatment price reduction B was 1.96 whereas price reduction A was 1.83. The results confirm the prediction of the hypothesis that the buyer will not reciprocate, by reducing the contract price, even if he believes the seller did not engage in side-selling.

## **9.6 Do buyers and sellers benefit from breaching the contract?**

This section examines profit from breaching or complying with contracts. It helps establish whether it is beneficial to breach a contract. First, it presents descriptive statistics of profit for the buyer and the seller when the contract is concluded. Then, the section further shows a combined profit from both contract and market interactions. In each case, a non-parametric test is conducted to examine the effect of treatments on profit. Finally, the section presents a linear regression analysis, examining factors influencing profit.

### **9.6.1 Profit obtained from trading with a contract**

#### **9.6.1.1 Descriptive statistics**

Profit for the buyer and the seller as well as their joint profit for trading with a contract is shown in Table 9.7. The average profit earned by the buyer amounted to 83.31 in the baseline, 74.46 in the enforced treatment, and 82.31 in the optional treatment. In the optional enforced treatment, earning was 71.10 and 85.49 in the optional non-enforced treatment. Turning to the seller, the average profit was 61.75 in the baseline, 76.43 in the enforced treatment, and 62.00 in the optional treatment. In the optional enforced and



optional non-enforced treatments, a seller made an average profit of 75.38 and 58.21, respectively.

Table 9. 7: Profit obtained from trading with a contract

Contract type	Buyer	Seller	Joint profit
BT	83.31	61.75	72.53
ET	74.46	76.43	75.44
OT	82.31	62.00	72.15
OET	71.10	75.38	71.85
ONET	85.49	58.21	73.24

The buyer made the highest profit in the optional non-enforced treatment and in the baseline where the contract price is not enforced. On the other hand, the seller made the highest profit in the enforced treatment where the contract price is enforced. Nonetheless, both made the highest joint profit in the enforced treatment.

### 9.6.1.2 Non-parametric test

The non-parametric test shown in Table 9.8 indicates a significant treatment effect on both buyer and seller's profit. The test shows that the enforced treatment significantly reduces the buyer's profit but increases the seller's profit. Alternatively, the buyer's profit is significantly higher in the baseline or optional non-enforced treatment whereas the seller's profit is low in these treatments.

Table 9. 8: Two-Sample Wilcoxon rank-sum tests for treatment effects on profit in the concluded contract

Treatment	Buyer profit	Seller profit
BT vs ET	0.02**	0.02**
BT vs OT	0.88	1.00
OET vs ONET	0.02**	0.00***

A Two Sample Wilcoxon rank-sum tests are performed at sessional level. \*\*\* (\*\*) [\*] Significance at 1% (5%) [10%] level.

## 9.6.2 Profit obtained from both contract and market trade

### 9.6.2.1 Descriptive statistics

This section considers a combined profit from trading through a contract and the market. On average buyer made a profit of 75.03 in the baseline, 71.68 in the enforced treatment, and 75.23 in the optional treatment. Seller's earning was 61.75 in the baseline, 76.43 in the enforced and 62.00 in the optional treatment. The results revealed a higher joint profit (combined profit for buyer and seller) in the enforced treatment. Table 9.9 shows the results.

Table 9. 9: Profit obtained from both contract and market trade

Type of contract	Buyer	Seller	Joint profit
BT	75.03	61.95	68.49
ET	71.68	70.43	71.06
OT	75.23	62.56	68.89

### 9.6.2.2 Non-parametric test

Again, in this section, the non-parametric test showed the buyer's profit was significantly lower in the enforced treatment compared with the baseline. On the other hand, the seller's profit was increased in the enforced treatment. The results are shown in Table 9.10.

Table 9. 10: Two-Sample Wilcoxon rank-sum tests for treatment effects on profit in concluded

Treatment	Buyer profit	Seller profit
BT vs ET	0.02**	0.02**
BT vs OT	0.85	0.85

Two-Sample Wilcoxon rank-sum tests are performed at the sessional level. \*\*\* (\*\*)[\*] Significance at 1% (5%) [10%] level.

## 9.6.3 Regressing analysis of determinants of profit.

This section presents results on a regression analysis of determinants of profit. Variables used in the regression model include contract price (pc), market price (psm), price reduction, side-selling, units of commodity delivered, and enforced contract price (ECP). The effect of the enforced contract price (ECP) is examined in the seller's model and not

in the buyer's model since price reduction is not applicable when the contract price is enforced. The results are presented in Table 9.11.

Table 9. 11: Determinants of profit

Dep var: Profit	Buyer profit	Seller profit	Joint profit 1	Joint profit 2
Pc	-13.04*** (16.27)	15.12*** (0.515)	1.537 (1.109)	2.159* (1.281)
Psm	-0.221 (0.075)	-0.713*** (0.256)	0.667*** (0.261)	0.784** (0.357)
Price reduction	12.38*** (0.216)			-1.642 (1.743)
Units delivered	6.420*** (0.055)			
Economics	-0.420 (0.305)	1.053 (1.077)	-1.693 (1.799)	-3919 (2.526)
Side-sell		3.918*** (0.183)	-2500*** (0.302)	-2.713*** (0.422)
ECP		28.04*** (1.122)	3.977** (2.056)	
Constant	48.00*** (1.219)	-27.20*** (2.930)	-12.01* (6.910)	-12.37* (7.656)
Observation	506	842	1685	1012
Prob X <sup>2</sup>	0.000	0.000	0.000	0.000
R-sq within	0.983	0.632	0.396	0.355
R-sq between	0.987	0.715	0.158	0.126
R-sq overall	0.984	0.664	0.300	0.232

NB: \* Significance at 10%, \*\* significance at 5%, \*\*\* significance at 1%; standard errors are in parenthesis.

The coefficient of the contract price, price reduction, and units delivered is significant in the buyer's model. The negative effect of contract price on buyer's profit implies that a unit increase in contract price decreases buyer's profit by 13. There was a positive relationship between price reduction and buyer's profit, indicating a 12.4 increase in buyer's profit for a unit reduction in the contract price. Further, the results indicate that a unit increase in the quantity of the commodity delivered increases the buyer's profit by 6.4.

For the seller, the coefficient of ECP, contract price (pc), market price (psm), and side-selling were significant, signifying their impact on the seller's profit. As shown in the seller profit in Table 9.12, ECP increases the seller's profit by 28, relative to the non-enforced

contract price. Further, the results show a unit increase in side-selling and contract price increases seller's profit by 3.9 and 15 respectively, whereas a unit increase in market price decreases profit by 0.71. Focusing on the effect of ECP on profit in joint profit 1, the coefficient showed that foregoing the right to review contract price (enforced contract price) increases profit for both buyer and seller. These results confirm the descriptive statistics showing a higher joint profit in the enforced treatment. In the joint profit 2, the coefficient of price reduction is not significant.

## 9.7 Summary

This chapter presented results from a descriptive and econometric analysis of a contract experiment between a buyer and a seller, with double moral hazard. The results showed substantial evidence of the existence of a double moral hazard in a buyer-seller contract without formal enforcement. First, a significantly higher proportion of buyers opted not to forego their right to reduce contract price suggesting a possibility of changing the initial contract price ex-post. In a baseline treatment in which contract price was not enforced, buyers tended to increase contract offers but reduced offers, and bought from the market instead, when contract price was enforced in the enforced treatment. Conversely, offers accepted by sellers increased significantly in the enforced treatment compared with the baseline treatment. Further, the results show evidence of reciprocity with regards to contract price offered and accepted. The seller demonstrated reciprocity in the optional treatment when the buyer voluntarily decided to forgo his right to review price ex-post (in the optional enforced treatment) by accepting a lower price. In contrast, the seller reacted to the buyer's decision to retain the right to review price (optional-non enforced treatment) by accepting a higher price. Again, the results showed that a mechanism that externally enforces contract price (the enforced treatment) and removes the possibility of a moral hazard by the buyer results in a lower accepted contract price.

On side-selling, the results revealed partial side-selling (partial breach) in all treatments. That is, the seller only sold some of the available units that could have been sold in the market. Further, the regression analysis showed evidence of reciprocity by the seller. There was an observed significant reduction in side-selling in the optional treatment when the buyer voluntarily decided to forgo his right to review the price. Also, the regression results

showed a negative effect of the enforced treatment on side-selling, providing a strong confirmation for the effectiveness of a mechanism that externally enforces contract price on mitigating side-selling as was evident in the non-parametric test.

The results showed that the buyer always reduced contract price ex-post, even when he believed the seller did not engage in side-selling. No significant difference existed in price reduction between the baseline and the optional non-enforced treatment. Individually, the buyer benefited from contract breach (in the baseline treatment) whereas the seller benefited when the contract price is binding (in the enforced treatment). A binding contract price, however, resulted in a higher joint profit for the buyer and the seller. In the next chapter, the results of the analysis are discussed.

## CHAPTER TEN

### Discussion of Experimental the Results

#### 10.1 Introduction

The experiment was designed to investigate double moral hazard in a non-binding buyer-seller contract and to examine whether removing buyer's moral hazard through an institution that takes a deposit corresponding to a value of the total revenue of the seller can mitigate the seller's moral hazard through reciprocity. First, a model of double moral hazard described in chapter seven was developed, and second, predictions of the model tested through economic experiment. The design of the experiment comprises a baseline condition with a double moral hazard, known as the baseline treatment (BT). This is based on the double moral hazard model described in section 7.3. The other conditions consisted of the enforced treatment (ET) and the optional treatment (OT). In the enforced treatment, which is based on the single moral hazard model shown in section 7.4, the contract price is enforced by default. The optional treatment is based on the double moral hazard with the optional binding price offer model described in section 7.5. This means in the optional treatment the buyer may decide to voluntarily forego his right to review the contract price, giving rise to a treatment called optionally enforced treatment (OET), otherwise the treatment was called optionally non-enforced treatment (ONET). The optional treatment is considered a voluntary institution that allows the buyer to decide whether or not he commits to a deposit corresponding to the value of the total revenue of the seller, whereas the enforced treatment denotes an institution that externally enforces a commitment to the deposit. This chapter discusses the moral hazard observed in buyer-seller interaction and the effect of the treatments in mitigating moral hazard.

#### 10.2 Moral hazard in contract offer and acceptance

This section discusses the moral hazard observed in the buyer-seller contract and offer possible explanations for the observed behaviour.

##### 10.2.1 Contract offer

The results have shown that buyers are generally more willing to offer contracts than sellers are willing to accept, in line with the expectations of the model. This confirms the initial

hypotheses for all treatments. A possible explanation is that a contract provides the buyer with insurance, guaranteeing access to a minimum quantity of commodities equal to what could be obtained in the spot market. This is in line with the real world where the spot market does not guarantee access to the required output and buying firms rely on contracts to secure the expected quantity of output. Moreover, and of much significance is, it allows the buyer to have control over price and reduces her risk of exposure to the higher market price. Narrowing on the different contract treatments, the results showed buyer preference for contracts involving double moral hazard. A double moral hazard contract ensures the buyer can reduce the contract price ex-post. Since a lower contract price increases buyer's profit, a price reduction is always a dominant decision for a self-interested buyer. Another reason is that, as a single moral hazard contract does not preclude the seller from side-selling, the anticipation of a possible hold-up from the seller makes the single moral hazard contract unattractive to the buyer. The impact of hold-up would be grievous if the buyer is locked in a contract that binds him. Also, a double moral hazard contract allows the buyer to retaliate against the seller's opportunistic behaviour and that possibly contributes to the buyer's preference. Perhaps, the buyer's preference would have changed if there was a contract arrangement that removed the seller's moral hazard, binding from the seller's side or at least binding on both parties. The study, however, did not explore behaviour in such a reverse relationship. Turning on contract acceptance, removing moral hazard by the buyer, as in the enforced treatment, increases contract acceptance by sellers.

The results showed evidence of the existence of a double moral hazard in a buyer-seller contract without formal enforcement. First, in the optional treatment, a large proportion of buyers decided not to forgo their right to review contract prices in line with the hypothesis. This suggested an intention to reduce contract price ex-post, demonstrating the existence of or an intention for moral hazard in a buyer-seller relationship. Rationally, a profit-maximizing agent would prefer to reduce price and increase her profit. Therefore, retaining the right to review price is consistent with economic theory. Preference for retaining the right to review price confirms why relatively fewer contract offers were made in the enforced treatment, and rather more offers made in the baseline treatment. Buyers' preferences for a contract that allows them to retain the flexibility to reduce the price or not

honour promise ex-post is confirmed by Fafchamps and Minten (2001) and Barrett *et al.* (2012) as a common practice in agricultural supply chain contracts in developing countries.

### **10.2.2 Contract offer price**

The results of the experiment demonstrate the presence of treatment differences in moral hazard behaviour by either of the contracting parties. In terms of the contract price, buyers behaved according to the prediction of the hypothesis by offering a price marginally higher than the expected market price in the enforced treatment or when buyers voluntarily decided to forgo their right to review price. Contrarily, when a contract involved double moral hazard, either in the baseline treatment or when the buyer voluntarily retains her right to review price, a lower price than was predicted by the model was offered. Justification for the behaviour can only be based on the supposition that the buyer would not reduce the price ex-post by 2. But an examination of contract price reduction reveals the buyer reduced price by 2 approximately.

### **10.2.3 Contract acceptance**

In line with hypotheses 2, 5, and 8 significantly higher proportions of sellers rejected contracts when the participation constraint was not met. What is surprising is that among these class of contracts, acceptance was higher in the optional non-enforced treatments and the baseline treatments. Considering that a buyer could further reduce contract price ex-post, the expectation was that a contract that failed to satisfy the participation constraint would be rejected. A possible explanation of behaviour is that sellers might be attracted to a higher promised (but non-binding) contract price in the baseline and the optional non-enforced treatments. These treatments though did not satisfy the participation constraint yet presented sellers with a higher nominal offer. The study did not elicit risk preferences, but the risk preferences of players may offer an additional explanation to the observed behaviour. A risk-seeking player may gamble on the promise of a higher price, disregarding the possibility of the buyer shirking. Another possible reason is that sellers may accept a lower contract price when they are not sure of the market price, as an insurance, and later side-sell when they realize the market price is higher. This practice has been observed between a tomato processing firm and contract farmers in Ghana (Robinson and Kolavalli, 2010).



### **10.3 Contract breach**

The contract breach discussed in this section involves side-selling by the seller and contract price reduction by the buyer.

#### **10.3.1 Side-selling**

Generally, side-selling was highest if a contract involved double moral hazard. A contract involving a double moral hazard means the buyer can shirk by reducing the contract price ex-post. The seller, on the other hand, can side-sell ex-ante. Similarly, and in line with the prediction of the model, sellers engaged in side-selling in all treatments when the market price was higher than the contract price, including when participation constraint was satisfied. A straightforward explanation for side-selling is based on the prediction of game theory. Since the buyer is the last mover, and he is free to shirk after the seller has delivered the commodity, the seller will side-sell as long as the market price is higher than the contract price, taken into account how much the buyer could shirk.

#### **10.3.2 Contract price reduction**

Comparing the two treatments with double moral hazard, the baseline treatment, and the optional non-enforced treatment, price reductions were not significantly different in the two treatments. As explained earlier, the decision to retain the right to review price is implicit of an intention to reduce price ex-post and, therefore, a higher price reduction was expected in the optional non-enforced treatment compared to the baseline. However, as the results show, price reduction did not increase. Why would a buyer not forgo the right to review price if he intends not to reduce the price after all? Standard economic theory suggests that rational buyers prefer to retain the opportunity to increase their profit by reneging the contract or to revenge suspected cases of side-selling. The price reduction trend in Figure 9.7 provides insight. The trend shows buyers were hesitant to reduce prices in their first period of contract. But, having learned later that sellers did engage in side-selling in the first period, buyers sharply reduced price in the second period and thereafter. The sharp price reduction in the second period is a possible reaction to side-selling in the first period. In the experiment, a buyer does not know the number of units of the commodity produced and could determine side-selling only at the end of a period. Hence, he could respond to, for instance, behaviour in the first period only in the second period.

### **10.3.2.1 Belief and contract price reductions**

People exhibit considerable reciprocity, reacting to a negative action with equally negative action and positive action with positive behaviour. Action can be an intention, how a decision-maker believes the other behaved. Therefore, in the experiment, a buyer's behaviour (price reduction) can be a response to her belief of the expected behaviour of the seller (side-selling). The results of the belief elicitation and the subsequent relationship with price reductions show buyers also reduced contract prices when they believed there was no side-selling. Therefore, the experiment did not provide any evidence to suggest that contract price reductions by buyers are a reaction to side-selling. This evidence establishes that a contract breach can be an inherent opportunistic behaviour of buyers. For example, Barrett *et al.* (2012) observed that the reason buying firms prefer to retain flexibility in a contractual arrangement is that they would be able to breach later.

## **10.4 Mitigation of double-moral hazard**

The preceding sections discussed the results of double moral hazard investigation and the consequences of double moral hazard in a buyer-seller contract. This section discusses the effect of the experimental treatments in mitigating moral hazard in a buyer-seller contract.

### **10.4.1 The effect of reciprocity on mitigating side-side-selling**

This section discusses the effect of the optional treatment on side-selling. As indicated in the introduction to this chapter, the treatment represents an institution that takes a deposit corresponding to a value of the total revenue of the seller. Standard economic theory considers human behaviour as purely self-interested, so that, for example, in strategic interaction, profit-maximizing behaviour dominates fairness and reciprocity in individual decision making. Advances in theories of human behaviour, however, show human action may deviate from purely self-interested behaviour, arguing that humans exhibit considerable reciprocity in social interactions. Empirical evaluation of trust games, ultimatum, and social dilemmas have shown consideration for reciprocity.

Contrarily to the prediction of standard economic theory, the results showed a significant reduction in side-selling in the optional treatment, which involves a voluntary decision by the buyer to let go of his right to review the contract price. This provides evidence of the emergence of positive reciprocity in a buyer-seller contract and its effect in mitigating moral hazard in line with the prediction of hypothesis 9 in the model. This suggests that an institution or a policy that allows the buyer to voluntarily commit to a deposit corresponding to the value of the total revenue of the seller could mitigate side-selling. This finding relates to substantial evidence of positive reciprocity in a buyer-seller relationship found in other studies. It conforms to earlier studies in the labour market by Fehr *et al.* (1997), Baker *et al.* (2002), and Davies and Fafchamps (2015) who found that workers exhibited positive reciprocity by exerting higher effort when employers offered a higher wage in a relational employment contract. Also, some evidence of reciprocity has been reported in a gift exchange game (Fehr *et al.*, 1993), in a trust game (Romero Granja and Wollni, 2019), and an investment game (Berg *et al.*, 1995).

Not only did reciprocity impacted side-selling, but it also was manifested, and affected contract price offered and accepted. The seller reciprocated the buyer's decision to voluntarily forgo his right to review the contract price ex-post by accepting a lower contract price. In contrast, the seller reacted to the buyer's decision to retain his right to review price by accepting a higher price. This suggests negative reciprocity in the buyer-seller relationship.

#### **10.4.2 The effect of external enforcement of contract price on side-selling**

The enforced treatment denotes an institution that externally enforces a buyer's commitment to a deposit corresponding to a value of the total revenue of the seller. As the results show, such an external institution that enforces the contract price, thereby eliminating the buyer's moral hazard, reduces side-selling significantly, and ensured the seller accepted a lower contract price. These results confirm the evidence and effect of reciprocity on side-selling. The two mechanisms suggest that, if a buyer's moral hazard could be removed, then the seller's moral hazard could be mitigated. The institution thus resolves the two-sided moral hazard. One party (particularly the one with the last mover

advantage) forgoing the possibility of breaching the contract sends a positive signal to the other party.

This study is not a trust game. However, forgoing the right to review price can be considered as the buyer signalling her trustworthiness. In the field survey conducted in Ghana, sellers indicated a lack of trust for buyers in subsequent contract relationships as a major alternative for the resolution of contract breaches. Often, discussions on supply chain coordination problems in developing economies have sought to blame sellers or suppliers for dishonesty in the fulfillment of a contractual agreement. Hence interventions or empirical research on fixing the problem have predominantly focused on getting sellers to be compliant. Insight from this experiment provides a different argument as follows. If forgoing the right to review price does mitigate side-selling, then side-selling may be justified as a reaction to perceived or anticipated ex-post opportunistic behaviour by the buyer. Therefore, a resolution of a buyer's breach could be a mechanism that increases the seller's trust in the buyer or conversely, proves the trustworthiness of the buyer. A commitment to forgo the right to review contract price by depositing an amount corresponding to a value of the total revenue of the seller provides a signal of buyer's trustworthiness, hence the decreased side-selling. This observation is in line with Romero Granja and Wollni (2019) who explored ex-post moral hazard on seller's (agents) trust in a trust game experiment in the agricultural markets and found that if the principal sent an ex-ante credible positive signal, indicating her trustworthiness before trading, sellers responded positively resulting in a significantly limited incidence of moral hazard.

The contract-market price difference (pcpsm) has been shown to affect side-selling. A higher market price than contract price usually resulted in side-selling in all contract treatments as revealed by the descriptive analysis. An interaction between forgoing the right to review price and pcpsm still showed a significant reduction in side-selling when forgoing the right to review price is enforced. A contrasting result was found when forgoing the right to review price was voluntary. The possible reason is that the treatment included only about 18% observations of buyers who decided to forgo the right to review price, hence the treatment bear more characteristic akin to the double moral hazard

treatment. As observed in the descriptive analysis, side-selling is relatively high when the contract involves a double moral hazard.

To further ensure effective mitigation of side-selling, negative reciprocity, where retaining the right to review contract price ex-post is met with increased side-selling, was expected. That is, contrary to the observation in the study, side-selling was expected to have increased in the optional non-enforced treatment compared with the baseline treatment. If a buyer decided not to forgo the right to review contract price, he is implicitly indicating an intention to reduce price ex-post. The literature on reciprocity indicates reciprocity can be intention-based. Therefore, sellers were expected to have negatively reciprocated the buyer's failure to forgo the right to review price by side-selling more in the optional non-enforced treatment than they did in the baseline treatment. Thus, the study found no evidence of negative reciprocity in terms of side-selling. Negative reciprocity, where opportunistic behaviours are punished has been observed by Carpenter and Matthews (2004). Participants in their study indicated a willingness to punish free-riders even at a personal cost. The result, however, conforms to the finding of Davies and Fafchamps (2015) who observed in labour markets in Ghana that employers continued to offer higher wages to employees even when they exerted lower effort.

### **10.5 Impact of forgoing the right to review the contract price on profit.**

In both cases involving either a contract or a combination of contract and market trade buyer's profit was high in the baseline and the optional non-enforced treatments when the contract involves double moral hazard. Removing the buyer's moral hazard through either a voluntary commitment to a deposit or an institution that externally enforces a commitment to a deposit leads to much higher and equal profits for both the buyer and the seller. Similarly, removing moral hazard results in a higher joint profit.

In summary, the results have shown that buyers are generally more willing to offer contracts than sellers are willing to accept. There is, however, a buyer preference for contracts involving double moral hazard. A single moral hazard contract does not preclude the seller

from side-selling and the anticipation of a possible side-selling from the seller makes the single moral hazard contract, in which the buyer cannot retaliate the seller's breach, unattractive to the buyer. Turning on contract acceptance, removing moral hazard by the buyer increases contract acceptance by sellers. The results showed evidence of the existence of a double moral hazard in a buyer-seller contract without formal enforcement. Side-selling was observed in all treatments when the market price was higher than the contract price but was highest when the contract involved a double moral hazard. The results provide evidence of the emergence of positive reciprocity in a buyer-seller contract and its effect in mitigating moral hazard. Thus, side-selling was reduced when the buyer voluntarily decided to forego the option to review the contract price ex-post. This suggests that an institution or a policy that allows the buyer to voluntarily commit to a deposit corresponding to the value of the total revenue of the seller could mitigate side-selling. Further, the results show that an external institution that enforces the contract price, thereby eliminating the buyer's moral hazard, reduces side-selling. These two mechanisms suggest that if a buyer's moral hazard could be removed, then side-selling could be mitigated.

## CHAPTER ELEVEN

### Conclusions, Limitations, and Recommendations for Future Study

#### 11.1 Introduction

The emerging global agri-food system has generated highly coordinated and consolidated food value chains, which bring in its wake a potential exclusion of most of the world's smallholder food producers from the global food chain. Over the years, contract farming has become an important coordination tool aimed at linking food producers to the downstream markets. However, side-selling continues to negatively impact the completion of these contracts and impact contract farming use, particularly in West African food markets. The overall objective of this study was to examine side-selling in the Ghanaian food supply chain and to investigate strategies for their mitigation. The first part of the study involved an examination of contract terms between agribusiness buying firms and their contract farmers and how these terms affect side-selling, using survey data from the Ghanaian vegetable supply chain. This part of the study was built on the conceptual framework that if side-selling in contracts must be mitigated, then the buying firm's choice of contract terms must be shaped by the uncertainties of market transactions that potentially generate side-selling. The second part of the study employed experimental economics methodology to investigate strategies for the mitigation of double moral hazard, in the form of side-selling and ex-post contract price reductions, in non-binding buyer-seller contracts in the context of agri-food markets. Having identified from the results of the field survey that the firms' choice of contract terms, partly drive side-selling, and both the buyer and the seller breach contract, this part investigated an institutional mechanism that can reduce contract breach by both agents.

This chapter presents the conclusions of the study. The conclusion from the field survey, base on which the experimental study was launched is presented in section 11.2. Evidence of double moral hazard in buyer-seller contracts is presented in section 11.3 whereas 11.4 presents measures for mitigating double moral hazard. Section 11.5 explains the implications of the experimental results on side-selling in the Ghanaian vegetable value chain while section 11.6 presents the practical application of a deposit scheme as an institution for resolving moral hazard in Ghanaian agricultural value chain contracts. The

study's contribution to knowledge is presented in section 11.7. Finally, limitations and recommendations for future studies are presented in section 11.8.

## **11.2 Contract terms and their effect on side-selling**

The literature on incomplete contracts shows that in the absence of public enforcement, informal mechanisms can be employed to mitigate potential breaches. In an informal contract farming context, where contract agreements are mostly verbal and third-party non-enforceable, this study argues that the choice of the contract terms plays an important role in mitigating breaches such as side-selling. To investigate how the choice of contract terms impact side-selling in the Ghanaian agri-food market contracts, a conceptual framework based on an insight from the transaction cost economics was developed. The framework argues that the buying firms' choice of contract terms must be shaped by the uncertainties of market transactions which are likely to lead to side-selling. Following the conceptual framework, a field survey was conducted to investigate existing contract terms and side-selling in the Ghanaian vegetable value chain. Logistic regression analysis was then performed to analyse the relationship between these contract terms and side-selling.

The results showed that the market specification contract was the main type of contract in the supply chain. Also, informal verbal arrangements were the main form of contract agreement between the buyers and the farmers. Contract terms employed in the supply chain included delayed payment, variable contract price, which is agreed 5 days before the required date for product delivery, shorter contract duration (frequent switching of contracts), farm gate delivery of the product, and 3 times farm monitoring per production season. Also, a considerable number of farmers who were recruited into contracts were associated with some form of farmer-based groups or farmer associations. There were fewer cases of the buying firm and the contracted farmer coming from the same community. Contract farms were on average located 65km away from alternative markets that offer opportunities for side-selling.



From the conceptual framework, side-selling would be reduced if contract term choices were shaped by the transaction uncertainties. This was confirmed by the study. Contract terms that focused on addressing uncertainties that potentially lead to side-selling were found to mitigate side-selling, while terms that failed to address these transaction uncertainties increased the likelihood of side-selling. First, the variable contract price, delayed payment, and shorter contract duration increased the likelihood of side-selling. The conceptual framework shows that the choice of price options can be a major source of uncertainty due to the volatility of the spot market price, a phenomenon frequently observed in the Ghanaian vegetable market. A fixed contract price would generally lead to side-selling when the spot market price rises. This justifies the case for a variable contract price that corresponds to the prevailing spot market price as observed in the supply chain. In this case, the contract price is the same as the current spot market price. The problem, however, originates from the timing of the agreement of the price and the frequent fluctuations of the spot market price. By agreeing on the contract price 5 days before the date for product delivery, the possibility of a change in the spot market price on the day of delivering the product is high in a market characterized by price volatilities. The normal practice must be to update the contract price to reflect the spot market price on the day of product delivery otherwise the temptation to side-sell increases in the event of a higher spot market price. Thus, the contract price agreement in the Ghanaian vegetable supply chain fails to address this uncertainty, leading to an increased likelihood of side-selling.

Side-selling was also driven by delayed payment. As shown in the conceptual framework, delayed payment increases the uncertainties about the buyers' ability and willingness honour promised payment. It leads to a suspicion that the buyer may shirk payment, particularly in a trading relationship beset with distrust. Lack of trust for buyers is a problem in the Ghanaian vegetable supply chain because of farmers' experience with buyers who usually fail to show up to pay for products secured on credit. Also, Ghanaian vegetable farmers are mostly smallholders and resource-poor and may not be able to wait for a later date to receive payment. Therefore, farmers may not abide by the contract if options for immediate payment are available in the spot market. The framework suggests that buyers can eliminate the drive for side-selling if they offer immediate cash payment contracts. The results showed that the contract duration was short and lead to side-selling.

The literature is replete with cases of failure of institutions for public ordering in contracts in Sub-Saharan African agricultural markets, particularly between food growers and buyers. From the conceptual framework, contract terms must consist of longer duration if breaches are to be mitigated in the absence of formal enforcement. The role of longer contract duration in an informal contract is to allow for repeated interaction and credible implementation of the threat of contract termination as a contract enforcement strategy. What it means to specify a shorter duration is that farmers have no future contract to protect, and the use of the threat of contract termination as an enforcement mechanism cannot be credible. Farmers will indulge in side-selling without fear of punishment if a side-selling opportunity arises.

On the other hand, the findings showed that farm monitoring, production management contract, and distance from farm to alternative market decreased the likelihood of side-selling. Farm monitoring mitigates side-selling because it addresses uncertainties with regards to potential under-declaring of farm yield, usually aided by information asymmetry between the buying firm and the farmer. Similarly, in production management contracts, the increased presence of the buyer on the farm enables him to verify output and thus, reduces farmers' ability to under-report yield.

The observations from the findings, and which is consistent with the conceptual framework is that lack of consideration of transaction uncertainties in the design of contracts will give rise to side-selling. The predominant side-selling in the Ghanaian vegetable supply chain contracts can be attributed to a contract design that fails to fully address the uncertainties that potentially generate side-selling in contracts. Two issues are worth highlighting regarding contract term choices. First, there is a possible lack of buying firms' understanding of the dimensions of transaction uncertainties that could generate side-selling in the supply chain. As observed in the contract farming literature, buyers are mostly responsible for the choice of the terms of a contract. In the Ghanaian vegetable supply chain, particularly in the traditional market channel, buyers are predominantly smaller sole proprietors with limited educational level. They may have a limited understanding of how transaction characteristics of the supply chain influence opportunistic behaviours and,

therefore, cannot craft appropriate contract terms to curb them. The second involves the buyers' choice of biased contract terms. Buyers may be interested in contract terms that offer them undue advantage over farmers, without detailed considerations of the incentives it offers against side-selling. For example, an offer of a shorter duration, non-repeated contracts, maybe strategically chosen to allow the buyer to walk out of the contract when market conditions make it beneficial to do so. This has been observed by Barrett *et al.* (2012) in his survey of contract farming in selected developing countries.

Contrarily to the widely held belief that farmers in developing economies generally prefer informal contracts, the study has shown a preference for a court-enforced contract. This lends support to similar findings in the contract farming literature and suggests a need for formal, court-enforced contracts in Sub-Saharan African agri-food supply chains. The efficiency of the court system in mediating conflicts in developing economies has, however, been questioned. In Ghana, one of the weaknesses of the court system that people often complained about is the long delays in prosecuting cases brought before it. The use of small farmer community courts or the granting of extra powers by the state to traditional opinion leaders to mediate contractual agreement and conflict of smaller nature can be implemented to complement the formal court system. The study identified a lack of trust for buyers as a major contributing factor for increased side-selling. Finally, the study found a lack of appropriate mechanisms for contract enforcement in the supply chain.

### **11.3 Investigation of double moral hazard and their mitigation**

The first part of the study identified that the choice of contract terms partly drives side-selling and that there is a lack of trust between the buyer and the seller, especially the seller not trusting the buyer to fulfill contract promises. The second part of the study concerned how to generate trust through an institution that takes a deposit of the promised contract price from the buyer. Through reciprocity, the seller is not expected to side-sell if the buyer voluntarily commits to a deposit. First, the existence of side-selling, meaning the seller selling some of the contracted product in the spot market, and buyer's contract breach, in the form of a reduced contract price, were further investigated with a more robust experimental method. Second, alternative solutions to contract breach were investigated.

The investigation started with the development of a buyer-seller static model with moral hazard, involving three cases. The baseline model proposed and analysed a case involving a double moral hazard where side-selling and contract price reduction by the seller and the buyer, respectively, were analysed. The second case considered the possibility of a policy that enforces the contract proposed by the buyer, turning the original model into a single moral hazard problem, as now only the seller can side-sell. The last case investigated the possibility of a voluntary commitment from the buyer to withhold a decrease in the contract price offered.

To test the hypotheses derived from the model, a contract farming experiment consisting of three treatments was designed between a buyer (as agribusiness buying firm) and a seller (a farmer). Following the theoretical model, the baseline treatment involved a contract between the buyer and the seller in which the seller is required to deliver some units of a commodity to the buyer, but the seller is free to shirk by side-selling while the buyer may shirk by reducing the promised price ex-post. This treatment which was based on the first part of the theoretical model was aimed at examining double moral hazard, namely side-selling and contract price reduction. In the second treatment which was based on the second case of the model, the buyer no longer could change the price offered in the contract. The goal was to investigate how an institution that enforces the contract price by taking a deposit from the buyer could resolve side-selling. The last treatment mimics the third case of the model and the buyer has an option to refrain from changing the price offered to the seller. This treatment examines how a voluntary institution through which the buyer commits to a deposit resolves side-selling.

### **11.3.1 Moral hazard in contracts**

The study found evidence of double moral hazard in buyer-seller contracts. There was but partial side-selling, meaning sellers only sold some of the available units of products that could have been sold in the spot market. On the other hand, buyers breached contracts by reducing promised contract prices even when they believed the seller did not engage in side-selling. There is a general belief that farmers free ride on buying firms in contracts, by side-selling and as shown in the introduction to the study, contract instability in the

Ghanaian food value chain has been attributed to side-selling by farmers. It is instructive, however, to note that while both parties breached the contract, buyers exhibited more opportunism in the experiment by free-riding on sellers when farmers have complied with the contract. This opportunistic behaviour of the buyers in the experiment confirms the observations from the survey of the vegetable supply chain. The survey showed that side-selling could be motivated by the lack of trust for buyers as they reneged on contract promises to farmers. Side-selling can, therefore, be described as a sellers' reaction to the buyers' contract breach. This is informative to the search for a mechanism to mitigate side-selling in agri-food markets. Implementing mechanisms to ensure buyers' compliance with contracts can be an important step to bolster sellers' trust, reduce side-selling, and enhance a stable contract relationship.

### **11.3.2 Measures for mitigating double moral hazard**

The experiment finally investigated strategies to mitigate double moral hazard using a deposit institution as an intervention. The results have shown that an institution through which the buyer commits to a deposit corresponding to a value of the total revenue of the seller could mitigate side-selling. A commitment to a deposit was implemented in two ways in the experiment. The first involved the buyer voluntarily making a deposit, meaning showing commitment to not reduce the contract price ex-post. A voluntary deposit constituted an effective side-selling mitigation institution through reciprocity. Despite the effectiveness of the mechanism, as the results show, buyers will not voluntarily commit to such an institution. Some form of incentives will, therefore, be necessary to promote the successful implementation of a voluntary deposit institution as contract enforcement from the buyers' side. The second form of a deposit institution involved one that externally enforced the buyer's commitment to the deposit. As the results showed, such an enforced mechanism (the enforced treatment) contributed to a much greater reduction in side-selling. Therefore, in the absence of buyers' willingness to commit to a voluntary deposit institution, government policy can enforce it. Since side-selling can be motivated by a lack of trust for the buyer due to the buyer's contract breach, the implementation of a deposit institution in the Ghanaian agri-food supply chain, which guarantees contract compliance by the buyer can resolve side-selling.

#### **11.4 Implications of the experimental results for moral hazard mitigation in the Ghanaian vegetable supply chain**

The results of the experimental investigation have shown that an institution that enforces a buying firm's commitment to a deposit institution or a voluntary commitment of the buyer to a deposit institution can reduce side-selling. The following explains why the experimental findings can be applied to mitigate moral hazard in the Ghanaian vegetable supply chain contracts, though there are concerns of external validity in generalizing experimental findings to real-world problems. In a comparative analysis of classical and behavioural economics, Levitt and List (2007) cited the differences between the features of a laboratory experiment and the real market as the reason why the insight from laboratory experiments may fail to generalize to real markets. They questioned whether findings from the lab experiments are descriptive of the world at large. These are concerns that are anticipated to affect how the findings from the experimental investigation can be applied to resolve moral hazard in the vegetable supply chain contract. For example, the experiment used student subjects from the United Kingdom, whose socio-economic conditions, cultural context, belief systems, and codes of conduct such as the rules of behaviour that guide people's decisions may significantly differ from farmer subjects in a developing country like Ghana.

However, the experimental design was based on a model that mirrored contract farming in Ghana. Besides, the main argument about external validity focuses on quantitative external validity, which is the fact that the estimated effect in the lab may not apply in the field. Meaning, the extent of the limitation of the deposit institution to resolving moral hazard in the Ghanaian food chain contracts may rather relate to the magnitude of the difference in the effect of the deposit institution in the lab compared to the magnitude of the effect that would be observed when applied in the field. This has been shown by Camerer (2011) in his response to the criticism of Levitt and List on external validity. He argued that how the features of the lab differ from the field make less of a difference in behaviour. Kessler and Vesterlund (2015) supported this point of view by arguing that in many field experiments the focus of the researcher is not to generalize the magnitude of the estimated effect to other environments. Thus, in terms of the observed behaviour the findings of the lab experiment, which shows that an institution that enforces a buying firm's commitment to a deposit or a

voluntary commitment of the buyer to a deposit can reduce side-selling, can generalize to contract farming in Ghana despite the differences in the cultural context and people's codes of conduct. In the lab experiment, subjects were presented with incentives that were meant to capture the central features of the environment in which real-world contract farming decisions are usually made. The experimenter had in mind a model that assumes that the laboratory environment does not differ from a comparable contract farming environment on a dimension that will change the sign of the comparative statics. In as much as the model of the study is correct, the reduction of side-selling through the deposit institution in the experiment should apply to contract farming in Ghana.

### **11.5 Practical application of a deposit scheme to agricultural contracts in Ghana**

The conceptual deposit institution investigated in this thesis can be practically implemented to mitigate contract breaches in agri-food markets. The meaning of the concept is that before a contract farming agreement between a buying firm and a farmer is concluded, the firm must make a deposit payment to a deposit-taking institution, and forfeits the deposit if he breaches the contract. The farmer is reimbursed his cost of production from the deposit amount in the event of a contract breach by the buyer. The calculation of the minimum amount of deposit the buyer must commit to and how much the farmer receives in compensation for contract breach can be based on an agreed formula determined by the deposit-taking institution. For example, this can be determined based on farmers' total production costs. The deposit will constitute a guarantee that the buyer will not breach the contract and thus, increases the trust of the farmers in the contract.

An existing government agency under the Ministry for Food and Agriculture can be resourced and mandated as a deposit institution and ensure that deposits taken are kept and protected by a financial institution. Alternatively, a new organization can be formed. To address the challenge of contract design and appropriate definition of contract terms as observed in the vegetable sector survey, the institution can serve an additional function as a contract broker between the buying firm and the farmer. This allows the institution to verify the credibility of buyers and farmers.

Buyers face two important potential challenges in the implementation of the deposit institution. The first is the potential cash flow problems buyers may face. Smaller firms, without sufficient cash flow, may find it challenging to raise the deposit amount. As an alternative, buyers may guarantee with their assets in instances of inability to raise the minimum deposit. The second challenge is the risk of hold-up by farmers if the buyer is locked in the contract after committing to the deposit. A possible solution to a potential hold-up entails the use of a register of farmers in contract farming as proposed by Poole *et al.* (2003). They studied the contractual vegetable marketing in Ghana and proposed that to curb breaches, farmers must register with a mandated government organization and obtain a certificate of registration, which is subject to withdrawal on failure to honour a contract. Thus, the deposit organization may serve this function as well, by ensuring contracting parties are certified as trusted members of the institution. With a database of registered farmers and buyers, the institution can penalize free-riding from farmers. It becomes easier to implement both bilateral and multilateral reputational strategies as contract enforcement when farmers' identities are known and easily traced.

### **11.6 The study's contribution to knowledge**

This study contributes to knowledge on agri-food supply chain coordination in two parts; first, it contributes to the literature on agri-food supply chain coordination by providing insight on how contract design can either drive side-selling and leads to contract instability or provide enforcement against side-selling in the absence of court-enforced agreement. The search for a solution to side-selling, which impacts negatively on agri-food value chain transactions and agro-industrial projects in developing countries, particularly those executed through contract farming has been a topical issue. Second, the study contributes to the literature on informal enforcement mechanisms in incomplete contracts as it identifies contract breach mitigation measures.

There is an emerging literature on preference for contract attributes and contract choices in the agricultural supply chain, which are considered important in ensuring participation and performance of a contractual obligation. The study contributes to this literature by examining if terms chosen by contracting parties offer incentives against opportunism,



which is necessary for coordination. The study notes that most of the terms governing contracts in the vegetable supply chain in Ghana rather provide incentives for side-selling and are, therefore, suggestive of the high incidence of side-selling crippling the supply chain. Also, the results suggest that it is not enough to examine a firm or farmer's preference for a contract attribute, as has been the focus of many recent contract farming literature, since their preferences may be biased, especially when parties involved do not have the requisite expertise in determining terms that render contract self-enforcing.

Also, the study contributes to the emerging literature, over the last two decades, on the behavioural impact of reciprocity and its roles in sustaining cooperation in contracts. The study provides evidence of the effect of reciprocity in mitigating the problem of cooperation and opportunistic behaviour in contracts. Further, in the context of agricultural value chain contracts, the study has revealed that an institution through which a buyer voluntarily commit to a deposit corresponding to a value of the total revenue of the seller significantly mitigates side-selling through reciprocity. Though buying firms may not be willing to voluntarily commit to a deposit, the study further found that an institution that externally enforces buyer's commitment to a deposit contributes to a much more reduction in side-selling.

### **11.7 Limitations and recommendation for future studies**

An important limitation of the study relates to the second part of the thesis which uses laboratory experimental methodology to investigate double moral hazards and strategies for their mitigation. First, the experiment was one shot and, therefore, could not examine the effect of repeated interaction on side-selling and contract price reduction. This could have provided further insight into the effect of repeated interaction on side-selling when the quantity produced is not fully observed. However, since the number of units of the experimental commodity produced by the seller is not observed by the buyer and the buyer cannot determine or observe a breach, this study assumed that repeated interaction that relies on termination of the contract as a punishment mechanism for contract breaches may not have a further impact on side-selling. The study examined sellers' behaviour when the contract is enforced from the buyers' side. The experiment could have as well limited the

sellers' option for side-selling to allow for the observation of the buyer's behaviour on price reduction when the seller is compliant. This could have allowed for the investigation of further strategies for enforcing side-selling other than reciprocity or imposing restrictions on the buyer. Another limitation of the study is the assumption of risk neutrality in the analyses of agents' behaviour. A potential explanation of the observed behaviour of agents particularly on the buyers' willingness to commit to a deposit and sellers' acceptance of a contract offer with or without a commitment to a deposit, is their risk attitudes. For example, the standard economic theory suggests that risk-averse agents will accept contracts involving a commitment to a deposit with a lower contract price as in the case of the enforced contract while a risk-loving agent will accept a contract with no commitment to a deposit but promises a higher contract price, as in the case of the non-enforced contract. A risk-averse buyer, on the other hand, will not lock himself in a contract that is binding on himself but not the seller.

The limitations of the study offer opportunity for future research. Though it is expected that repeated interaction will produce similar results as the one-shot game analysed in this study as long as there is not full information on side-selling, future research could examine the impact of repeated interaction with the same experimental design. Kunte *et al.* (2016) examined repeated interaction in a similar context as this study but assumed perfect (full) breach which is mostly not the case in real-world agricultural production contracts. Moreover, future research considering different experimental designs focusing on enforcing the contract from the seller's side or both sides will provide valuable insight on parties' behaviour. Another important limitation of the study was the lack of resources, both financial and time, to replicate the study on the field. Considering the study's potential policy impact on coordination in the agri-food supply chain, a field experiment using real farmers as subjects would be important in terms of its external validity. Future work would, therefore, replicate this study on the field.

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## APPENDICES

### Appendix 1: Experimental instructions

#### Welcome and thank you for attending this session of our experiment

This is an experiment on decision-making, and you will earn money for your participation. The amount of money you will earn depends on both your and, partly on, decisions of other participants. The experiment is expected to last about 2 hours 30 minutes.

Please read the following instructions carefully. These instructions will help you make your decisions. If you face any difficulty understanding any part of the instructions, please raise your hand and we will come and assist you. All the money you earn during this experiment will be paid to you in cash at the end of the experiment. You are not allowed to communicate with any other participants or talk throughout the experiment. Please switch off your mobile phones to avoid any distractions.

You will be given a show-up fee of £3 for coming today. Also, you can earn more based on your decisions. We will be using an experimental currency unit called ECU. In the end, the total ECU you have earned during the experiment will be converted to GBP at the exchange rate of **1 ECU = £0.20**. For example, 10 ECU=£2.0, 50ECU= £10, 100 ECU=£20, 156ECU= £31.2.

#### Summary of Experiment

In this session, you will have three tasks to perform in parts. The first part consists of an experiment and in the second part, you will be asked to complete two questionnaires. The experiment has 12 rounds. The first 2 rounds are practice rounds and your choices will not affect your earnings. The purpose of the practice rounds is to help you understand the tasks involved. Your earnings will be chosen randomly from one of the ten rounds and paid to you together with your show-up fee at the end of the session.

You will be randomly assigned the role of either a **Buyer** or a **Seller** and will remain in this role throughout the experiment. Communication between the two roles will be via the computer. Your identity is **anonymous to other participants in this session**; in other words, neither you nor the person you are matched with will know the identity of the other

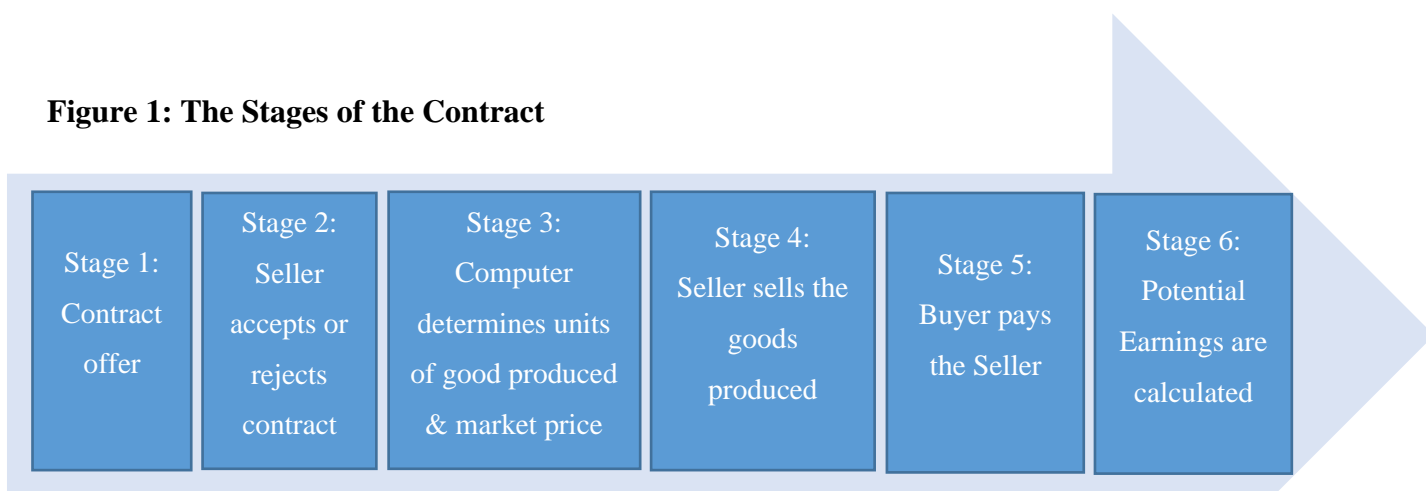
participant. In each round of this session, you will be randomly matched with a *different participant in the opposite role*.

### Part 1: The Experiment

The **Buyer** and the **Seller** could trade a given Good by setting a contract or using the external market. The value of the good to the buyer is 10 ECU per unit. If a contract is used, the buyer chooses the price per unit of the good. If the Buyer decides to use the market, he/she takes the market price as given.

There are 6 stages involved in each round as shown in figure 1 below.

**Figure 1: The Stages of the Contract**



#### Stage 1: Contract Offer

The **Buyer** offers a contract to the **Seller** and sets the price per unit of the good. The **Contract Price** takes any value ranging from **1 – 7 ECU**.

#### Stage 2: Seller Accepts or Rejects Contract Offer

The **Seller** observes the price and decides whether or not to accept the contract. If the **Seller** rejects the contract, he/she needs to sell all the units produced in the market. In this case, the **Buyer** can buy 11 units in the market, and earnings determined. If the **Seller** accepts the contract, he/she can *either deliver all units produced to the buyer or sell part in the market*.



### **Stage 3: Computer Determines Units of Goods Produced and Market Price**

The computer randomly determines the number of units produced, which ranges from 11 to 20 with equal probability. Also, the **Market Price** is randomly determined by the computer ranging from **1 to 7 ECU** with equal probability.

### **Stage 4: Seller Sells the Goods Produced**

The **Seller** observes the market price and then decides whether to deliver to the **Buyer** all units produced or sell part in the market. If the contract was accepted, the seller must deliver a minimum of 11 units.

### **Stage 5: Buyer Pays the Seller**

In this stage, the **Buyer** observes how many units are delivered by the **Seller**.

He/she then decides the **Final Price**. The Buyer can reduce the **Contract Price** by up to 2 ECU.

### **Stage 6: Potential Earnings are Calculated.**

The computer calculates potential earnings from this round and displays your potential earnings on your screen.

### **We will now show you how you can calculate your earnings**

#### *Earnings when a contract is accepted*

- **Buyer's Earnings** =  $10 * \text{Units Delivered (by the Seller)} - \text{Price paid to Seller} * \text{Units Delivered}$
- **Sellers Earnings** =  $\text{Units Delivered (to Buyer)} * \text{Price (set by the Buyer)} + \text{Units Sold in the Market} * \text{Market Price}$

#### *Earnings when a contract is rejected*

- **Buyer's Earnings** = 10 \* 11 Units Bought in the Market – Market Price \* 11 Units Bought in the Market
- **Sellers Earnings** = Units Produced \* Market Price

## Examples

Please note that all examples are aimed to solely illustrate how earnings are calculated.

**Example 1:** Assuming the **Buyer** offers a contract price of 5 ECU. The **Seller** accepts the contract and produces 18 units of Good and the market price was 6 ECU. The **Seller** delivered all 18 units to the **Buyer**. The **Buyer** paid a final price of 5 ECU. What are the earnings of the **Buyer** and the **Seller**?

**Answer:**

$$\text{Buyer's Earnings} = 10 * 18 - 5 * 18 = 90 \text{ ECU}$$

$$\text{Seller's Earnings} = 5 * 18 + 6 * 0 = 90 \text{ ECU}$$

**Example 2:** Assuming the **Buyer** offers a contract price of 5 ECU. The **Seller** accepts the price and produces 18 units of Good and the market price was 6 ECU. The **Seller** delivered 11 units to the **Buyer** and sold 7 units in the market. The **Buyer** paid a final price of 5 ECU. What are the earnings of the **Buyer** and the **Seller**?

**Answer:**

$$\text{Buyer's Earnings} = 10 * 11 - 5 * 11 = 55 \text{ ECU}$$

$$\text{Seller's Earnings} = 5 * 11 + 6 * 7 = 97 \text{ ECU}$$

**Example 3:** Assuming the **Buyer** offered a contract price of 5 ECU. The **Seller** accepts the contract and produces 16 units of Good and the market price was 4 ECU. The **Seller** delivered all 16 units to the **Buyer**. The **Buyer** paid a final price of 3 ECU. What are the earnings of the **Buyer** and the **Seller**?

**Answer:**

$$\text{Buyer's Earnings} = 10 * 16 - 3 * 16 = 112 \text{ ECU}$$

$$\text{Seller's Earnings} = 3 * 16 + 4 * 0 = 48 \text{ ECU}$$

**Example 4:** Assuming the **Seller** did not accept contract from the **Buyer**. He produced 14 units of Goods and the market price was 3 ECU. What are the earnings of the **Buyer** and the **Seller**?

**Answer:**

$$\text{Buyer's Earnings} = 10 * 11 - 3 * 11 = 77 \text{ ECU}$$

$$\text{Seller's Earnings} = 3 * 14 = 42 \text{ ECU}$$

**Example 5:** Assuming the **Seller** did not accept the contract from the **Buyer**. He/she produced 14 units of Goods and the market price was 7 ECU. What are the earnings of the **Buyer** and the **Seller**?

**Answer:**

$$\text{Buyer's Earnings} = 10 * 11 - 7 * 11 = 33 \text{ ECU}$$

$$\text{Seller's Earnings} = 7 * 14 = 98 \text{ ECU}$$

## **Appendix 2: Questionnaire for the survey of the vegetable supply chain in Ghana**

### **Questionnaire**

This questionnaire will provide Cosmos Adjei, a student of Newcastle University, the UK with valuable information to enable a detailed examination of a contract arrangement between vegetable producers and buying firms in the vegetable supply chain in Ghana. There is an urgent need to understand the causes of contractual breaches between farmers and buying firms and find appropriate strategies to remedy them.

### **Questionnaire anonymity**

All questionnaire responses will be treated confidentially, and no reference will be made to specific information provided by individual respondents.

### **Research finding**

Apart from submission to Newcastle University as part of a Ph.D. thesis, the results of the research would also be made available to the Vegetable Producers and Exporters Association of Ghana (VEPEAG). Technical pieces of the research may also be produced and published in academic journals.

### **Important Information**

This questionnaire is to be answered by vegetable farmers who presently have contractual relations with buying firms and have at least have a contract (with the same or different buyer) continuously in the past 5 seasons.

### **Questionnaire structure**

The questionnaire has many sections. These sections solicit information related to different aspects of the important parameters of contract characteristics considered to affect contract breaches.

**Please circle answers where applicable**

**Section A: Background information**

1. Are you currently having a contract with a vegetable buyer? Yes  No
2. What type of major vegetables do you grow? .....
3. What is the total size of your farm (in acreage) .....
4. In which of the following regions is your vegetable farm located?
  - a. Greater Accra
  - b. Eastern Region
  - c. Central Region
  - d. Volta Region
5. What is the approximate distance from your farm to the nearest market for the vegetable that you grow (km).....
6. How many years have you been growing vegetables?.....
7. What is your highest educational background?
  - a. No Education
  - b. Primary
  - c. Secondary/Technical/Vocational
  - d. Tertiary
8. What is the size of your household? .....
9. Could you please tell us your age? .....
11. Gender of respondent.....

**Section B: Marketing Channel**

12. Who is the buyer of your vegetable?
  - a. Exporter
  - b. Domestic supermarket
  - c. Hotel/Restaurant
  - d. Local trader

**Section C: Contract characteristics**

13. Which of the following best describes your contract?
  - a. Marketing arrangement
  - b. The buyer supports me with advice on agronomic practices and extension services but does not provides inputs
  - c. The buyer supports me with inputs and extension services
14. What is the duration of your present contract? .....years
15. How many years have you been in contract with the present buyer..... years
16. In the last 5 years, how many buyers have you changed? .....

17. Which of the following is true about your buyer?
- a. The buyer comes from my community and I knew him/her before the contract
  - b. The buyer does not come from my community but I knew him/her before the contract
  - c. The buyer comes from my community but did not know him before the contract
  - d. The buyer does not come from my community and did not know him before the contract
18. Do you have a written contract with the buyer? Yes  No
19. Do you belong to a farmer group? Yes  No
20. When do you and the buyer agree on the price of your products?
- a. Before planting vegetable
  - b. Before harvesting vegetables after they are matured
  - c. We agree on a price for every harvest

If you did not answer C continue from question 22

21. When exactly do you agree on the price for each harvest? .....days before harvest
22. Where does the buyer take delivery of the harvested produce?
- a. On my farm
  - b. I transport to the buyer
23. When do you receive payment for your sold produce?..... days after delivery

**Section D: Contract Breaches**

24. In the last five years has any of your buyers breached a contract? Yes  No
25. If yes, what was the nature of the breach? List all that applies .....
- .....
- .....
- .....
- .....

**Contract breaches resolution strategies**

26. How do you resolve a contract breach with the buyer when it occurs? List all strategies that used

.....  
.....  
.....  
.....

**Side-selling**

27. In your opinion why do you think farmers sometimes sell contracted produce outside the contract?

.....  
.....

28. How many times have you sold contracted produce outside the contract in the last five years?

.....

**Views about side-selling**

29. Indicate your views on the following statement about side-selling by assigning them numbers from 1 to 5 where 1 = don't agree and 5 = strongly agree

- a. Side-selling is acceptable behaviour
- b. Most vegetable farmers in Ghana engage in side-selling
- c. Side-selling is okay if the buyer is a government agency
- d. Side- selling is okay if the buyer is a large company
- e. Side-selling is okay if the buyer is not trustworthy
- f. Side-selling can lead to a collapse of the buying company

30. Indicate your preference for the following contract terms by assigning them numbers from 1 to 5 where 1 = not preferred and 5 = the most preferred

- a. Payment for produce on delivery
- b. Fixed price contract
- c. Contract price based on spot market price
- d. Farmgate delivery of produce

- e. Grading of produce and premium pay for quality grade
- f. Court enforced contract
- g. Non-binding contract
- h. Long term contract
- j. Production management contract
- k. Resource providing contract
- l. Market specification contract
- m. A contract that specifies quantity in units of produce
- n. A contract that specifies quantity in acreage/ hectares



## **Appendix 3: Buyer questionnaire for the survey of the vegetable supply chain in Ghana**

### **Questionnaire for a buyer**

This questionnaire will provide Cosmos Adjei, a student of Newcastle University, the UK with valuable information to enable a detailed examination of a contract arrangement between vegetable producers and buying firms in the vegetable supply chain in Ghana. There is an urgent need to understand the causes of contractual breaches between farmers and buying firms and find appropriate strategies to remedy them.

#### **Questionnaire anonymity**

All questionnaire responses will be treated confidentially and no reference will be made to specific information provided by individual respondents.

#### **Research finding**

Apart from submission to Newcastle University as part of a PhD thesis, the results of the research would also be made available to the Vegetable Producers and Exporters Association of Ghana (VEPEAG). Technical pieces of the research may also be produced and published in academic journals.

#### **Important Information**

This questionnaire is to be answered by vegetable buyers/buying firms who presently have contractual relations with farmers and have at least have a contract (with the same or different vegetable producer) continuously in the past 5 seasons.

#### **Questionnaire structure**

The questionnaire has many sections. These sections solicit information related to different aspects of the important parameters of contract characteristics considered to affect contract breaches.

**Please circle answers where applicable**

**Section A: Background information**

1. Are you currently having a contract with a vegetable producer? Yes  No
2. What major vegetables do you buy? .....
3. What is the total size of your farm (in acreage) .....

**Section B: Marketing Channel**

4. Which type of firm are you? a. Exporter  b. Domestic supermarket   
c. Hotel/Restaurant  d. Local trader

**Section D: Contract Breaches**

5. In the last five years has any of your farmers breached a contract? Yes  No
6. If yes, what was the nature of the breach? List all that applies .....  
.....  
.....  
.....  
.....

**Contract breaches resolution strategies**

7. How do you resolve contract breach with the farmer when it occurs? List all strategies used  
.....  
.....  
.....  
.....  
.....