Allocation of Control Rights in Fruit and Vegetable Contracts

Yamei Hu

George Hendrikse

1 Introduction

The use of contracts as a way of vertically organizing transactions is spreading in many agricultural sectors. Although cash markets are still important in coordinating supply and demands, however, different kinds of contractual arrangements gradually demonstrate their significance in providing links to all stakeholders. According to USDA/ERS (2006), contracts covered 39 percent of the value of U.S. agricultural production in 2003, up from 36 percent in 2001 and 28 percent in 1991. Commodities such as tomatoes and broilers have been produced almost exclusively under contracts between processors and independent growers for decades in the United States (Vukina and Leegomonchai, 2004).

Growing and/or marketing agricultural products under contracts, or *contract farming* in simple term, are different from spot markets, because contract farming specifies delivery requirement of a product or a service *ex ante* and a set of rules or provisions may be adopted for guarantying the final delivery. Contract farming is a vertical relationship in the sense of combining upstream primary producers and downstream marketing or processing firms *ex ante*. In contrast to fully vertically integrated systems, such as investor-owned agricultural corporations, contract farming offers primary producers more independence in making decisions and primary producers remains independent entities.

Within the broad category of contract farming, contractual arrangements vary a lot across different supply chains/relations. *First*, some contracts align the ownership of the commodity to the processor, while other contracts do not. For example, a DuPont high-oil corn contract

specifies that farmers do not obtain any ownership rights to the crop because DuPont owns the crop; rather, farmers are caring for DupPont's property (Hamilton, 1999, cited from Goodhue, 1999). *Second*, some contracts specify the restrictive provisions regarding input choice, and/or production method. Several prior studies notice the input control aspect in contracts (Goodhue, 1999; Hueth et. al, 1999). A survey on the contractual relations between growers and first handlers in California fruit and vegetable markets shows that 46 firms of 88 firms surveyed specifies or provides seeds to control seed variety, and, some firms even specify the planting, pruning and harvest (Hueth et.al, 1999). In broiler industry contracts, processors may control almost every aspect of production from the distribution of inputs (chicken and feed) to decisions about when to harvest the mature bird and repopulate the houses with new flocks (Vukina and Leegomonchai, 2004). *Third*, contracts are different in setting up pricing provisions to farmers.

These observations briefly demonstrate that contract farming provide a set of different rules and incentives to govern the parties involved. We focus on the elements of contractual arrangements regarding decision rights commonly found under a contract farming governance structure. The extent of shifting decision rights across two parties varies, as we have observed in the real world.[1] On one extreme, contract farming could be extensive by the processor allocating quota, controlling quality, controlling most production aspects, and even owing the residual claims of the commodity; on the other extreme, contract farming could be limited by the processor exerting few control on farmers' activities. What determines the form and extent of control rights allocation across two parties in contract farming?

We will address the above question in one particular agricultural sector, i.e., fruit and vegetable sector. Thus, the main research question is w*hat determines the form and extent of control rights*

[1] For example, Menard (1996, p.170) identifies three types of contracts when observing French poultry industry: fixed-price contracts; buy-and-sell contracts; and contracts of the putting-out type.

allocation between farmer growers and downstream processors in fruit and vegetable contracts. To answer this main question, we further develop two sub-questions. Firstly, many decisions/issues are specified in contracts ex ante. The more issues are specified in a contract, less space is left for parties to decide later on and behavior uncertainty is decreased. Completeness of a contract is increased by including more specifications and reducing discretion for parties. Thus, by focusing on the specifications ex ante in a contract, we will address the first sub-question: *what determines the completeness of a contract?* Secondly, when contracts are not complete, control rights should be carefully allocated to each party. As we know, agricultural contracts are involved with two major parties: upstream farmer growers and downstream agricultural firms. By focusing on one party, we will get full picture of control rights allocation. Thus, the second sub-question is *when control rights are allocated to downstream agricultural firms?*

In sum, we empirically examine the determinants of the completeness of a contract and the allocation of decision rights / control rights in case of incomplete contracting. Our theoretical objective is to contribute to the literature which tackles the endogeneity of the degree of 'completeness'. Our practical objective is to better understand the practice of contract farming and thus help managers to effectively manage the relations between producers and processors.

The paper is organized in 5 sections. Section 2 presents contract farming hypotheses, section 3 addresses the research design. The data is analyzed in section 4. Section 5 ends with conclusions.

2. Contract farming hypotheses

2.1 Conceptualizing contract farming

An important insight of the modern theory of the firm is the need to allocate carefully the right to make decisions about issues that can not be contractually specified (Lerner and Mergers, 1998,

p.125). Decision rights in the form of authority and responsibility address the question 'Who has authority or control (regarding the use of assets)?'. Decision rights concern all rights and rules regarding the deployment and use of assets (Hansmann, 1996). They specify who directs the firm's activities, i.e. the allocation of authority.

Figure 1 distinguishes four governance structures including contract farming from the perspective of allocating authority/control rights/decision rights.[2] The setting of a supply transaction involves an upstream party (farmer suppliers/growers), a downstream party (agribusiness/buyers) and two assets (e.g., production equipments). In Figure 1, rectangles represent productive assets, crosses inside rectangles represent control rights of the assets, and ovals represents when two parties are coordinated somehow.

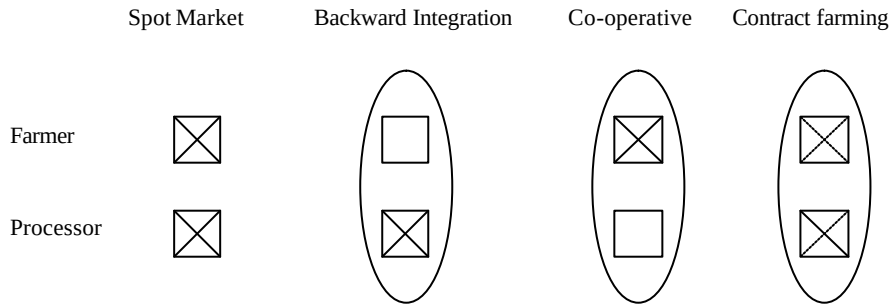

Figure 1 Four governance structures

Under *spot market governance structure,* two parties are independent, and prices are the coordination force behind behavior. Under *backward integrated firm governance structure,* upstream players are not independent anymore in sense of the production assets are owned by the downstream party. Ownership of the assets implies that the access to the productive assets (and consequentially to the returns of the assets) is controlled by the downstream owner and thus upstream farmers work as employees. Control rights reside with downstream players, and authority acts as the major coordination mechanism. Under *co-operative governance structure,*

[2] Hence forth, decision rights, authority and control rights are used interchangeably.

individual farmers own their upstream production assets and thus hold residual control rights on their assets. The downstream productive assets are owned together by farmers. Under *contract farming*, upstream farmer remains independent in the sense that they work with their own productive assets such as landing, growing facilities, etc. It means that farmers are autonomous to decide on how to use their assets and how to deal with the resulting products. However, this autonomy is constrained by the intervention from the downstream party via ex ante specified and/or ex post implemented authority to downstream party. This character is captured by the dotted cross inside the rectangle. Ownership may not change, however, control rights across fixed firm boundaries may be moved using contracts (Baker, Gibbons and Murphy, 2005).

To sum up, contract farming is broadly defined as the arrangements between upstream farmers and downstream processors under the agricultural contracts. Contract farming can be treated as hybrid governance structures lying between two polar forms of spot market and completely integrated firms.

2.2 Extent of completeness/incompleteness of contracting hypotheses

Battigalli and Maggi (2002) model the contract incompleteness as arising endogenously from the costs of writing contracts, i.e., the costs of describing the environment and the parties' behaviour. A contract is viewed as specifying obligations for the agent. Different from the prior studies emphasizing mainly missing clauses, they argue that the optimal contract is characterized both by rigidity and by discretion: *discretion*, meaning that the contract does not specify the parties' behaviour with sufficient detail; and *rigidity*, meaning that the parties' obligations are not sufficiently contingent on the external state. In their term, the clauses of a contract can be ranked as three groups: contingent clauses describe both future contingencies and parties' actions, incur the highest writing cost, and are used to regulate the most important tasks; rigid clauses only

describe parties' actions (like instructions given by a superior to other agents), incur relatively lower writing cost, and are used to regulate less important tasks; discretion clauses (i.e. missing contingencies) leaves the discretion to parties, incur no writing cost, and are used to regulate the least important tasks. The optimum degree of discretion and rigidity is determined by the trade-off between the writing costs and the potential surplus (gross of the writing costs).

Battigalli and Maggi (2002) examines how changes in the importance of writing costs relative to the potential gross surplus affect the optimal degree of rigidity and discretion of a contract (denoted as c/A). The degree of rigidity (captured by the number of rigid clauses in the multi-task principle-agent model) is increasing for low values of c/A and decreasing for high values of c/A, while the degree of discretion (captured by missing clauses in the model) and the amount of contingent clauses are both increasing in c/A. A good description is given by Figure 3.

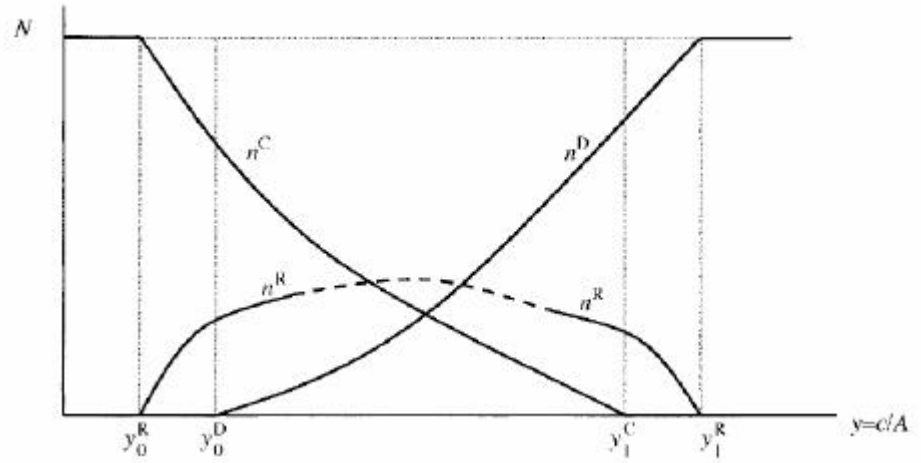

Figure 2 Impact of change in y on the optimum contract (Battigalli and Maggi, 2002, p.808)

A close look at the comparative statics regarding this proposition generates testable hypotheses on contract incompleteness. Let's focus on A. Other things being equal, A increases, i.e. the potent gross contracting surplus increase, the optimal degree of rigidity is expected to increase, and the degree of discretion is expected to decrease, and the possibility of observing contingent clauses is expected to increase too. In detail, when the potential gross contracting surplus is very

small, no contract can be agreed upon since the contracting costs may be too high to prohibit formulating a contract. When the potential gross contracting surplus is very large, the optimum contract specifies each contingency and actions because the writing cost can be neglected, i.e., complete contracts emerge. In addition to these two extreme situations, there are other situations where it is more interesting to predict and compare the contract completeness. When the potential gross contracting surplus is small, an optimum contract is expected to specify some (rigid) clauses while leave large space to agents' discretion. As it become larger, the discretion space left is decreased while the space for contingent and non-contingent instructions/specifications is increased.

Thus, the larger the value of contracting is, the less discretion is left to agents, more issues are specified in contracts. Thus, the completeness of a contract is positively influenced by value of contracting.

In two cases, value of contracting may be increased for firms. Firstly, if firms deal with high *quality* products, procuring material by contracting may have advantage over procurement from spot markets. In spot markets, both quantity and quality of products may not be stable enough for firms' marketing or processing. To buying required materials, firms have to spent lots of efforts and resources to search, screen, and bargain with suppliers. Contracting may save transaction costs for firms by locating suppliers ex ante and by guaranteeing quality of supplying ex ante and/or ex post.

The second case is that firms have well recognized *reputation*. Reputation is invisible capital which facilitates firms' business in many ways. It usually takes many efforts and investment to build up reputation. However, reputation is fragile to being ruined. Contracting can reduce the chances of destroying reputation by procuring unsatisfactory materials.

Thus, we have the following two hypotheses:

Hypothesis 1: Completeness of a contract increases when the firm deals with high quality products.

Hypothesis 2: Completeness of a contract increases when the firm have well-recognized reputation.

Uncertainty is identified in Battigalli and Maggi (2002) as another factor determining the extent of incompleteness of a contract. It is stated that rigidity is decreasing as uncertainty increases, while contingent and discretion are increasing as uncertainty increase. The intuitive argument is as follows (p.809): *'when uncertainty is higher the efficiency cost of ignoring low-probability events and writing rigid clauses is higher, hence the number of rigid clauses is lower. Moreover, when uncertainty is higher, both contingent clauses and missing clauses increase in number'*. It is depicted by the following figure (Battigalli and Maggi, 2002, p.809). The two dots indicate the critical levels of the incremental benefit from matching events with actions that separate, respectively, D (i.e. discretion) from R_n (i.e., Rigid clauses in contracts), and R_n from C_n (i.e., Contingent clauses). As uncertainty increase, an optimum contract will leave more space for parties' discretion, and reduce rigid/specified tasks/activities which are not dependent on contingencies.

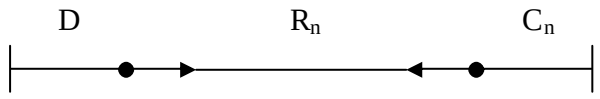

Figure 4 Effect of increase in uncertainty on the optimum contract,
(Battigalli and Maggi, 2002, p.809)

Applying this prediction to agricultural contracts, we have the following hypothesis:

Hypothesis 3: In more uncertain environment, the completeness of a contract is decreased.

2.3 Control rights allocation hypotheses

Gross and Hart (1986) and Hart and Moore (1990) formalizes the hold-up problem caused by opportunism and specific investments/relations in the setting of incomplete contracting. They define the ownership of assets as the holder of residual control rights: the rights to make any decision regarding the use of an asset that is not explicitly attenuated by law or assigned to other parties by contract. The integration involves benefits as well as costs, and the assignment of control rights, hence ownership, should be allocated to the party who can create most value to a specific relation, because it affects ex ante investment incentives via the influencing mechanism of bargaining power.

Aghion and Tirole (1994) develop the property rights model from GHM when researching the relationships between small research firms and larger financial firms. According to them, two factors determine how control rights are allocated: firstly, and consistent with classical GHM model, the extent to which *underinvestment* by either or both of the parties jeopardized the success of the project; Secondly, the relative *bargaining power* of the two parties. The variable of bargaining power is motivated by the limited ability of many small high-technology firms to obtain outside financing. When research firms are short of financing, even the marginal impact of its research effort on the value of final output is greater than the marginal impact of the financing partners' financial investment, the property rights may not be allocated to research firms.

Underinvestment problem is a relevant issue for contract farming. Both farmers and processors have to make specific investments to make transaction successful. Farmers need to deliver products with specified quality, and processors need to sell out the products at satisfactory prices. For farmers, they may need purchasing special productive assets, such as greenhouse or irrigation facility; and, they may need to speed time and effort on learning new production technology. For processors, they may need to buy storing facility and/or special transportation car; they may also

need to train their employees to efficiently collecting marketing information, and/or establish or maintain marketing channels, developing niche markets. For each party, breaching contracts from other party may cause sunk costs which can not recovered by finding alternative buying/selling alternatives. The higher sunk costs are, the more specific their investments are to the relationship. Control rights should be allocated carefully to induce two parties' investment incentives. Thus, we expect control rights in agricultural contracts should be allocated and balanced in such way that the both parties' specific investments can be protected as much as possible. The hypotheses are therefore:

Hypothesis 4: more control rights will be allocated to the firm, as the level of firms' specific investment increases.

Hypothesis 5: Less control rights will be allocated to the firm, as the level of firms' specific investment increases.

In fruit and vegetable supplying transaction, bargaining power is also an important issue. Processors' bargaining power generated from financial means are larger compared with individual small farmers. However, this bargaining power may be strengthened or decreased by processors' competition status. If the processor has monopsony-oligopsony power, that is, there is no or few competition buyers (including markets) within a certain geographical area, then farmers have less choice to sell their products. To gain access to marketing channels, farmers may give up their autonomy in making decisions for market access via contracts. Monopsony-oligopsony power thus can be transformed into bargaining power of processor, and further induce more authority allocated to processors. Thus, we have

Hypothesis 6: More control rights are allocated to firms, if firms have monopsony-oligopsony power.

Arrunda, Garicano and Vazquez (2001) examine the allocation of rights and monetary incentives in 23 automobile franchise contracts. The empirical findings show that all contracts substantially

limit the decision rights of franchisees, and grant extensive implementation ad enforcement powers to manufactures. The extent of restrictiveness of contracts across the brands is explained by the incidence of moral hazards. They point out both vertical externalities (Klein and Murphy, 1988) and horizontal externalities (Telser, 1960) exits in the dealer manufacturer relationship. Manufacturer also has potential moral hazards problem, which is constrained by brand names. It is suggested that a trade-off between the risk of ex post opportunism on the two sides (i.e., both franchisor automobile manufacturers and franchisee dealers) drives the allocation pattern of control rights. When the cost of dealer moral hazard is higher and the risk of manufacturer opportunism is lower, the manufacturers hold more rights to determine the performance required from their dealers and to use mechanisms such as monitoring, termination, and monetary incentives to ensure that such performance is provided.

Similar to franchising, agricultural contracts also generalize externalities from producers' side. As agricultural products become more and more specialized, many contractors require high quality products by providing specific quality and safety attribute standards. However, quality attributes of agricultural commodities has inherently high degree of heterogeneity (Ligon, 2002, Cited from Carriquirey 2003). This variability stems mainly from the randomness of the production environment and/or the heterogeneity of the practices employed by farmers.

A farmer grower may, without being detected within supply chains, provide a low-quality product to the processor/retailer who processes or sells the product under their brands. By shirking, a farmer saves his efforts in providing specified quality attribute. Shirking may have two negative effects. Firstly, the low-quality product attribute may be detected by final consumers, which eventually reduces their value perceptions on the brand. Thus, the costs of shirking are borne by the brand-owner, i.e. processor or retailers. Secondly, when bad behavior

can not be detected, high quality producers will have to share the loss from decreased value of the commodity or the brand with the processor/retailer. Anticipated of this, producers will under-invest in quality-enhancing techniques. This has been identified in contract literature (for example, Hennessy (1996) and Chalfant et al. (1999)). Thus, because of two negative effects of shirking behaviour, the more quality attributes and the combined brand is important to processor or retailers, the more the costs of vertical externality are larger.

As in franchising, ex post opportunism from processors in farmer-processor relationships is possible too. The centralized contract, that is the processor is in charge of most decisions, can promote opportunistic behavior by the processor (Bogetoft and Olesen, 2002). Centralized contracts usually shift the authority to make most of the decisions away from producers to the processor. For example, many broiler contracts require a big initial investment on chick housing, and/or specifies guidance format to grow chickens. Assume producers have made specific investment, no matter on efforts or on physical assets, to deliver specified products. The processor may reject the delivery by downgrading quality attributes or ask for a discount on agreed-upon prices, when the market situation is not good for selling. Since it is hard to verify if the ex post renegotiation claims is based on real situation or on simply opportunism, producers may have to give up all or greater part of his share of quasi-rents since his investment is sunk into this specific relation. To anticipate this, producers may hesitate to make efficient relationship specific investments, even though his investment is valuable to create greater values for the whole chain. Thus, in agricultural contracts, hold-up problems faced by producers will influence producers' decisions on accepting centralized contracts or decentralized contracts.

In consistent with Arrunda, Garicano and Vazquez (2001), we also expect that control rights allocation will be determined by the extent of the opportunism risks of two sides in a specific

supply chain. When high quality of contracted products is important for the processor, the costs of opportunism risks from growers are greater. In this case, more control rights will be allocated to processors. When processors have good reputation, the risks of hold-ups will be reduced, the willingness of accepting authority from processors will be increased. Thus, we expect that

Hypothesis 7: More control rights are assigned to the firm, when the firm deals with high quality products.
Hypothesis 8: More control rights are assigned to the firm, when the reputation of the processor is better recognized.

3. Research design

3.1 Research method

Multiple case study is adopted as the major research method. Case study research is appropriate to research what-type and why-type research questions on contemporary events without control of behavioral events (Kin, 2003). A 'case' in our research is the contracting relationship between primary farmers (grower or sellers) and agri-business (buyers, including all kinds of marketing and/or processing firms). The unit of analysis is contractual arrangements between two parties.

Data extraction methods are mainly semi-structured interviews based on a questionnaire. It is useful to acquire written contracts, but written contracts can not be our major data source because of two reasons. Firstly, we expect it is difficult to gather commercial contracts because of confidentiality issue. Secondly, we also consider oral contracts. Thus, interviews are the right data extraction method for our purpose, and whenever possible, written contracts will be collected and analyzed too to increase data reliability.

Interviews are based on a semi-structure questionnaire. The questionnaire is developed from prior empirical studies and our major concepts. Major part of the questionnaire is designed to collect data on control rights specification and allocation in contracts. Interviewees are the persons from agri-business who knows the details and operations of contracts.

3.2 Selections of cases

We choose 4 fruit and vegetable agricultural firms in Shandong province. Shandong province is located in eastern coastal China, and is well known for its vegetable and fruit production. The case company is carefully chosen by considering both variability on contracting practices and the researchers' access capability to case companies.

3.3 Major concepts and measurements

Contract completeness

As we define in early section, the more issues are specified and written into a contract, the more complete a contract is. Thus, *completeness of contracts* is measured by number of clauses in a contract.

Control rights allocated to firms

Control rights are related with these issues/decisions not specified in a contract. cross vegetable and fruit supply chains, many issues are involved in order to deliver products to final consumers. Figure 4 captures the important issues involved in producing and marketing process. We distinguish input control rights, in-process control rights, after-process control rights, monitoring control rights and termination control rights and some other control rights. We add up the number of rights allocated to one party (i.e., processor in our analysis) as the index of authority allocated to one party. This method has been adopted in several empirical studies (Arrunada, Garicano, and Vazquez, 2002; Lerner and Merges, 1998). Of course, simply adding up number has problems, because it treats each control rights with the same weight. To partly deal with this problem, we will further look into each sub-group.

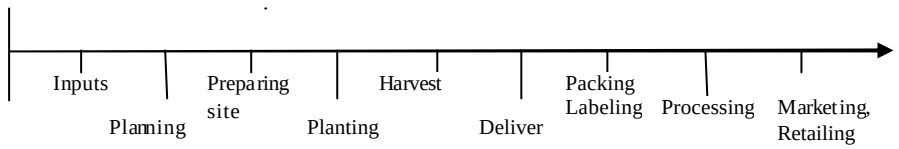

Figure 4 Issues/decisions involved in producing and marketing process (adapted from Allen and Lueck, 2003, p.184)

Quality

Quality is measured by the quality standards adopted by firms when procure and market products. In China, there are four levels of national quality certification: NPF (Non-Pollution Food), GF (Green Food), OF (Organic Food). The vegetable with these national certifications are thought to have higher quality than non-certified vegetable. In addition, some vegetables are sold under international quality certification. Some international quality certifications may be stricter than some national quality certification. Thus, to measure the quality standards required by a firm, we let the interviewee first specify the quality standards/certification. In case of international certification, they are asked to compare this quality standard with GF standards. If a firm requires no national or international quality certification, the quality standard of vegetables of this firm is ranked as low; if a firm requires NPF and GF, its quality standards is ranked as medium; if a firm require any national or international quality certification higher than GF, its quality standard is ranked as high.

Reputation

Arrunada, Garicano, and Vazquez (2001) measure reputation by the length of the relationship between two contract parties. For our purpose, this measurement for reputation is not satisfactory, because contract farming is a new phenomenon in China and thus contracting experience may not vary enough among different firm-grower supply chains. We use two kinds of measurements.

The first measurement is *brand name capital*. If a firm has invested a lot on its brand and accumulated brand name capital, the firm is more likely to develop and sustain reputation. This measurement is approached by asking the firm's branding strategy and expenses. The second measurement is *official honor/award*. In china, governments still play an important role in coordinating and/or supervising enterprises, although they do not intervene in the operations of enterprises any more in most cases. In recent years, rural development and agricultural industrialization are one of policy focus for governments. The governments have both incentives and ability to screen good or bad agricultural firms. Thus, the honors awarded to one specific firm can be treated as a mirror to reflect how well the firm establishes its reputation in markets.

Uncertainty

Uncertainty is a complex concept. For our purpose, we mainly focus on uncertain environment. In an uncertain environment, firms feel difficult to predict supply and demand and price may fluctuate a lot. We use the difficulty level of market (price and supply, demand) prediction to measure uncertainty. The following question is asked to the interviewees, "for the vegetable you mainly deal with, is it difficult to predict demand, supply, price? " The interviewee is required to choose among 5 levels: 1 not difficult at all; 2 not very difficult; 3 difficult; 4 very difficult; 5 extremely difficult. Uncertainty is scaled from 1 to 5 in ascending order, i.e., 1 is the lowest level of uncertainty while 7 is the highest level of uncertainty.

Firm's specific investment

Firm's specific investment is measured by specific physical investment and human capital investments. We ask 5 questions to measure overall level of specific investment: the first two questions let the interviewee to evaluate the physical investment in procuring, processing and marketing products and potential loss in case of changing or closing current business. The third

and fourth questions let the interviewee to evaluate the training practice to employees on procuring, processing and marketing and potential loss in case of changing or closing current business. The fifth question let the interviewee to evaluate the investment on quality control. All answers are scaled by five levels from 1 to 5 in ascending order: 1 refers to no specific investment and 5 highest level of specific investment. By summarizing up the five answers, we get the specific level of firm's specific investment.

Farmers' specific investment

farmers' specific investment is measured from two perspectives: physical specific investment and human capital investment. Since we interview the firms instead of farmer growers in our study, it is difficult and not practical to find contracted growers to answer the two questions. Alternatively, we ask the interviewees to evaluate farmer's specific investment. Better measurements can be acquired supposed the interviewees are both familiar with farmers' operations and judge the level of investment fairly. During the interviews, we are assured that the interviewees are familiar with farmers' activities. However, the validity of the measurement may be influenced by the interviewee' arbitrate judgment. It implies that we have to be especially cautious when drawing any conclusion by using this measurement.

Monopsony-oligopsony power

The interviewee is required to evaluate the number of potential competitor frm which may contract with growers. If within the same period, many competitor firms may contract with growers, any individual firm is less powerful when bargaining with farmers. Thus, the monopsony-oligopsony power can be measured by potential competitor contractors available for growers. The more potential firms exit, the lower monopsony-oligopsony power the firm has.

4. Data analysis

4.1 General Information on case companies

Table 1 provides general information regarding the case firms. Case A and B are large agricultural firms and diversified in several related agricultural sectors. Case C and D are relatively small firms and are specialized in fresh and/or processed vegetable business. Three case firms export vegetables, and Japan is a dominant destination. Only case D sells vegetables in domestic markets.

Table 1 Basic Information on Four Case Firms

Case / Characteristic	Case A	Case B	Case C	Case D
Company establishment	1986* (re-established)	1994	1992	2002
ownership	Shareholding company	Private joint venture	Shareholding company	Private company
No. of fixed employees	21,000	1,800	200	180
Sales in 2005 (*million yuan)*	26,020	1,200	28	18
Percentage of vegetable business	20% in all exports	Main business	99%	100%
Percentage of export in vegetable business	60%	100%	100%	0%
Persons interviewed	Manager	General Manager	Export & import manager, office manager	Business manager, Manager assistant

4.2 Contractual arrangements

4.2.1 Price term

In case A and case B, the price is determined by the firm by calculating costs of plants in contracted land. In the rest two cases, both contracts specify the pricing as the cash price at delivery.[3] In none of the cases, the price paid to farmers is obviously based on the price of final products sold at downstream. However, in one case, farmer growers do share the benefits of downstream marketing by gaining returns from the firm.

[3] In practice, case C usually adds a premium (e.g. 0.05 yuan in 2005) to current unit cash price for the contracted vegetable. Case D usually adopts the higher cash price among various cash prices at delivery date.

4.2.2 Quantity term

When Sykuta and Parcell examine the quantity terms of identity-preserved soybean production contracts, they find all sample contracts are denominated in acres, although the price premiums are paid on the number of bushels of GMO-free soybeans delivered (Sykuta and Parcell, no 25). They call these contracts acreage contracts.

In our study, two cases (A, B) are dominated in acreage while the two others are dominated in kilograms. According to Sykuta and Parcel, acreage contracts shift some of the production volume risk to the buyer (p.341). How buyers deal with it? Firstly, compared with the buyers specifying kilogram requirement, the two buyers with acreage are much bigger in size. It reflects the larger processing and marketing capability, which may increase firms' flexibility for dealing with temporal surplus or deficiency. Secondly, both firms adopting acreage contracts closely supervise/monitor growers' production volume. In the contract from case B, it reads (clause II 6) "*when the party B finishes planting seeds, the grower must inform the party A, and party B must cooperate with party A to measure the actual seeding acreage, which will be adopted as the basis for delivery quantity*". By providing seeds before seeding and measuring seeding acreage after seeding, the firm has a clear idea on potential delivery quantity and thus abnormal surplus or shortage of delivery won't happen.

4.2.3 Control rights

The control rights are listed in table 2. We will look into several sub-groups of control rights one by one. Firstly, four cases show small variations on control rights regarding input. For the four potential input control activities, three case firms are allocated three: the rights to control seed, fertilizer and pesticide, and the fourth case firm controls fertilizer and pesticide. No case firm can decide planting, irritation and cropping facilities to be used by growers. One reason for all four

cases controlling fertilizer and pesticide may be related with the specific industry we choose in this study, i.e., vegetable industry. The quality of vegetables is highly dependent on what fertilizer/pesticide to use and how to use them. [4]

Secondly, four cases demonstrate variations on in-process control rights. For the 7 potential control activities, two cases are allocated 4 control rights while the other two cases are allocated only 1 or 1 control rights. It is worth mentioning the control rights on cultivating here. All four cases seem to control cultivating somehow. All four contracts requires growers to grow according to firms' technical guidance and field management requirement or guidebooks. Growers are still taking care the daily cultivating operations, however, these operations must be aligned with the firm's requirement. All four case firms send their technicians to supervise and guide the growing activities.

Thirdly, four cases have many commons in allocated after-process control rights. All four cases have rights to decide deliver time, to measure quality, to sort, size and grade, and to label. Two points should be mentioned here. At first, three cases (case A, B and D) clearly state that they make calls to growers when they need products, the products are delivered immediately after harvesting. Case C claims that the firm has rights to decide deliver time and location, although the way of informing growers are not told. Case C is processing and exporting processed garlic, which is less perishable than fresh vegetables such as spinach. It may be the reason why growers store the harvest for some time before delivery. At second, no growers have rights to measure

[4] The manager in case A tells us, "when and how to use pesticide is very important to control quality. We send technicians to inspect the fields two times a week. It is required that our quality guarantee staffs must be on-site when growers spread pesticide. Our quality guarantee staffs will supervise what pesticides to use and the compounding of pesticides. the use of pesticides before harvesting is especially important for us. We call the ten days from pesticide spreading to harvesting 'Pesticide Security Management Period'. During these ten days, the fields will be supervised 24-hour around. "

quality of their delivery. This piece of rights is allocated absolutely to firms. In all four cases, no third-party is involved.

Fourthly, regarding monitoring rights, the fulfillment of delivery and the rights of direct field visits are allocated to all four case firms, while two case firms can additionally ask growers to record their field operations.

Fifthly, three firms are allocated the rights to terminate contracts by judging if growers breach contractual terms.

Table 2 Control Rights Assigned by Contract to Agricultural Firms

Case / Control rights	Case A	Case B	Case C	Case D
Price of delivery	*	*		
Quality specification	*	*	*	*
Input control rights: *total number*	3	3	3	2
Specified or provided seeds	*	*	*	
Specified or provided fertilizer	*	*	*	*
Specified or provided pesticide	*	*	*	*
Specified or provided planting, irritation, cropping facility				
In-process control rights: *total number*	5	5	2	1
Planting plan	*	*		
Plowing				
Seeding		*		
Cultivating	*	*	*	*
Use of Fertilize	*			
Use of pesticide	*	*		
Harvesting	*	*	*	
After-process control rights: *total number*	5	5	6	4
Packing before delivery	*	*	*	
Storing before delivery			*	
Delivery time	*	*	*	*
Quality measurement	*	*	*	*
Sorting, Sizing, grading, packing for weighing and labeling	*	*	*	*
Labeling	*	*	*	*
Monitoring rights	3	3	2	2
Fulfillment of delivery	*	*	*	*
Direct inspections of growers	*	*	*	*
Grower' duty to provide field recording	*	*		
Termination rights	*	*		*
Total number of control rights	**19**	**19**	**14**	**11**

4.3 Testing Hypotheses

The data on each variable are listed in table 4. We will check each hypothesis one by one.

4.3.1 Quality, contract completeness and control rights allocated to firms

The data shows that two cases require high quality products while two cases require medium quality products. In detail, case A specifies high quality standards based on Japanese strict regulation on pesticide residuals, and case B specifies high quality standards based on ISO9002 and HACCP, case C and D specify relatively lower quality standards based on national quality standards Non-Pollution Food and Green Food.

Both case A and case B have strict quality requirement for vegetables. In case B's contract, the clause I.4 reads, '*Contractor A makes specific quality standards for all procured vegetables (based on ISO 9002 and HACCP)*'. When we interviewed in case A, the manager spent nearly 15 minutes to describe the importance of high quality requirement and how the firm try to guarantee the quality by contracting instead of by procuring from market. [5]

Case C and Case D have relatively lower quality requirement. In case C, the firm also exports processed vegetables to Japan. It once had HACCP certification. However, the manager told us they require NPF standard when procuring vegetable. In case D, the firm sells fresh vegetables in domestic markets. NPF and GF are required when procuring vegetable from contracted growers.

In case A and B, high quality standard requirement is related with higher number of allocated control rights, i.e. 19. As quality standard requirement is decreased to medium level in case C and case D, the allocated control rights to firms are also decreased to 14 and 11. Thus, quality may be positively related with the control rights allocated to firms.

[5] In Case A, 90% of vegetable are exported to Japan. Japan has strict regulation on pesticide residuals, antibiotics and additives of exported fresh and processed vegetables, especially since 2002. To deal with Japan's rising demand on high quality, an office is set up in Japan to acquire the most recent information on legal requirements and regulation on food. The firm specifies strict quality requirement when procuring vegetable. To measure and test quality, the firm has invested around 20 million yuan in laboratories. Further, it is going to buy one new pesticide residual testing machine, which costs 310,000 yuan, to strengthen current 2 ones.

Since case A and C can not provide the information on completeness of contracts, we just check the rest two cases. Case B and case D vary in the firm's quality standards, which gives us a nice chance to test the hypothesis. In Case B, quality is high and the number of the control rights allocated to firms are also larger. As quality is decreased to medium level in case D, the number of the control rights allocated to firms decreased as well. It means that quality may be positively influencing the control rights allocated to firms.

Table 4 independent variables and dependent variables

Cases / Variables	Case A	Case B	Case C	Case D
Dependent Variables				
contract completeness	–	20 clause	--	8 clauses
control rights allocated to firms	19	19	14	11
Independent Variables				
quality	High	High	Medium	Medium
reputation				
-brand name capital	National recognized	Local recognized	No brand	Local recognized
-official honor/award	Many national honor/award	Some provincial honor/award	Some local honor/award	Some local honor/award
uncertainty	Medium	Medium	Medium	low
firm's specific investment	High	High	High	Medium
farmer's specific investment	Low	Low	Low	Low
monopsony-oligopsony power	Medium	Medium	Medium	Large

4.3.2 Reputation, contract completeness and control rights allocated to firms

As we argue in the data collection section, two kinds of measurements are adopted to measure reputation: brand name capital and official honor/award. Now we check the two measurements one by one.

Firstly, let us look at the first measurement of reputation: *brand name capital.* The four cases demonstrate large difference in this measurement. Case A is national well-recognized brand. In 2005, the firm spent 1,000,000 yuan in advertising. Although the advertising fee is large compared with other three cases, the fee is quite small compared with its sale volume (i.e., 2.6 billion yuan). The manager told us the advertisement is mainly for selling vegetable and related

products in domestic markets. If only selling products to abroad, sustaining old customers are more important than acquiring recognition in foreign markets. In other word, if not for domestic marketing, the firm won't spend too much in advertisement.

This consideration is also reflected in other cases. The general director also showed no interest in advertising the firm's brand in case B. we were told that managers dealing with foreign larger customers are key to decide the success of a firm, not any brand on itself. In case C, the manger told us directly his firm won't waste the money in registering brand. Case D is different from other three cases because it is mainly playing in domestic market. The two interviewees agree branding is important. The firm spent 6,000 yuan in advertisement in 2005.

It is not clear if brand name capital positively influence the completeness of a contract. In case B and case D, both firms have locally recognized brands and spent some money on advertising. However, the completeness of the contract in case B is higher than case D. It says nothing to our hypothesis.

We can't draw any conclusion on the brand name capital (which is supposed to measure the reputation) and control rights allocation either. Case A and case D seems to provide support to our hypothesis at first glance, since better brand name recognition is followed by larger number of allocated control rights while weaker brand name recognition is followed by lower smaller number of allocated control rights. However, case C and case D makes the picture obscure by adding a fact that more control rights are allocated to a firm with no brand at all.

Secondly, let us check the second measurement of reputation: *official honor/ award.* case A is the most well recognized firm because it is awarded as 'national dragon-head enterprise' and meanwhile acquired several national awards such as '500 Leading China Manufacturing

Enterprise' '100 Leading China Food Enterprise' etc. Case B is awarded as 'provincial dragon-head enterprise', and case C and case D are awarded as 'local dragon-head enterprise'.

The positive relationship between official honor/award and control rights allocated to firms is supported in case B and case D. In case B, the honor/award is from provincial government, which implies that the reputation is established and recognized at larger scale than local environment. Correspondingly, the control rights allocated to firms are more than case D where official honor/award is from lower-ranked governments.

Meanwhile, the data shows that as official honors and awards are decreased, the control rights allocated to firms never increase, i.e., in case B it remains the same while in case C and D it decreases. Thus, the relationship between acquired official honors and awards and allocated control rights may be positive.

4.3.3 Uncertainty and contract completeness

Three cases evaluate the uncertainty of market where the firm is in as medium level of uncertainty, while in case D the firm thinks that uncertainty of the market is limited.

In Case B, the uncertainty level is medium while the written clauses summed up to 20 clauses. By contrast, in case D, the uncertainty level is decreased to lower level, while the written clauses are decreased to 8 clauses. These two cases do not support the hypothesis of uncertainty being negatively associated with the completeness of a contract.

4.3.4 Firm's specific investment and control rights allocated to firms

In four cases, firms make specific investment on both physical investment and human capital investment. Three cases claim that their firms' specific investments are high while only the firm in case D thinks its specific investment is medium. In case D, human capital investment is

thought to very important. The firm makes lots of efforts to train staffs for marketing knowledge and skills.

In Case A, firm's specific investment is high, and the control rights allocated to firms are 19. In case B and C, both firms' specific investment is high, although company B is obviously larger than company C. in Case B, corresponding to high level of specific investment, the firm is allocated to 19 control rights. In case C, the number of allocated control rights is decreased to 14, however, it is not the smallest number in four cases. In Case D, as the specific investment is decreased to low level, the allocated control rights to the firm is corresponding decreased to the lowest, i.e., 11. What we learn from the four cases is, therefore, as specific investment is decreased, the control rights allocated to the firm may be decreased as well. In other word, level of specific investment by firms may be positively related with the control rights allocated to firms.

4.3.5 Farmer's specific investment and control rights allocated to firms

In four cases, the farmer grower is thought to have only low level specific investment, both in terms of physical investment and capital investment. Since there is no variation among the independent variable while the dependent variable demonstrates variations, we can not draw any conclusion for the relationship between farmer' specific investment and the control rights allocated to firms. Two reasons may account for this result. First, farmer's specific investment may not be the influencing factor on allocating control rights between two parties. Although farmers made specific investment, this investment seems too limited to drive farmers argue for more decision rights. Second, the measurement of farmer's specific investment should be approached by other way. For example, we should directly ask farmers to evaluate their own activities.

4.3.6 Monopsony-oligopsony power and control rights allocated to firms

In all four cases, firms have at least some extent of monopsony-oligopsony power. This is in accordance with the fact that farmer growers are weak in most transactions. Three cases demonstrate medium level of monopsony-oligopsony power while one case claims the high level of power. It is interesting to point out that the case company claiming high level of power is the smallest firm among the four cases. It implies, at least in our study, that monopsony power is not related with size of firm. Comparing the four cases, we find two reasons explaining high monopsony power in case D. One is the market where the firm is in, and the other is the grower from whom the firm procures vegetables. This smallest firm mainly deals with fresh vegetables in domestic markets. When asked about the competitiveness of the market where the firm in, we were told that the competition is not very intensive. The reason is that they develop a market niche by making use of rapid rise of supermarkets. The firm signs contracts with supermarkets to supply them with high-quality fresh vegetable. Since most agricultural firms around this firm are less sensitive to the development of supermarkets, it establishes its success in marketing to supermarkets. In case A, B, and C, relatively large-sized farmers are contracted. For example, in case A, the smallest contracted landing scale for one grower is 100 mu. In contrast, in case D, the firm makes transactions with small-sized farmers. The firm contracts with more than 200 farmers, and each farmer provides 1 to 3 sheds. Compared with large-sized farmers, small-sized farmers have fewer alternatives to contract with other firms because they are small in size and may be lack of reputation.

Case A, B and C demonstrate medium level of monopsony-oligopsony power, and the control rights allocated to firms are varies from 14 to 19. As monopsony-oligopsony power is increased to high level, the control rights allocated are decreased to only 11. Thus, the hypothesis of

positive relationship between firm' monopsony-oligopsony power and allocated control rights is not supported.

4.3.7 Summary

We summarize the empirical result on each hypothesis in table 5. Among the 8 hypotheses, 5 are supported by the four cases while 2 are not supported. Two main findings are as follows. Firstly, quality, reputation may positively influence the completeness of a contract. Secondly, when the firm deals with high quality product, has well-recognized reputation, and have made huge specific investments, more control rights will be allocated to the firm when signing contracts.

Table 5 Empirical Results

Hypothesis	**Dependent Variable**	**Independent variable**	**Predicted sign**	**Empirical result**
Hypothesis 1	Contract completeness	Quality	+	Supported
Hypothesis 2	Contract c ompleteness	Reputation	+	Supported
Hypothesis 3	Contract completeness	Uncertainty	-	Not supported
Hypothesis 4	Control rights allocated to firms	Firm's specific investment	+	Supported
Hypothesis 5	Control rights allocated to firms	Farmer's specific investment	-	Not clear
Hypothesis 6	Control rights allocated to firms	monopsony-oligopsony power	+	Not supported
Hypothesis 7	Control rights allocated to firms	Quality	+	Supported
Hypothesis 8	Control rights allocated to firms	Reputation	+	Supported

5. Conclusion

We empirically examine the determinants of the completeness of a contract and the allocation of decision rights / control rights in the context of fruit and vegetable contracting. It shows that the extent of completeness of a contract and allocation pattern of control rights vary a lot across different supply chains. A contact may be complex when the firm designing the contract have well-recognized reputation and/or sells high quality products. Market uncertainty won't influence the completeness of a contract in our cases. Under contracting governance structure, many control rights are shifted from farmers to firms. Quality, reputation and specific investments may positively influence the number of control rights allocated to firms.

References

Arrunada, B., Garicano, L. and Vazquez, L., 2001. Contractual allocation of decision rights and incentives: the case of automobile distribution, Journal of Law, Economics and Organization, 17(1), 257-284.

Bajari, P., and Tadelis, S., Incentives versus transaction costs: a theory of procurement contracts, The Rand Journal of economics, 2001, 32(3): 387-407.

Battigalli, P., and Maggi, G., 2002, Rigidity, discretion and the costs of writing contracts. *The American Economic Review*, 92(4), pp.798-817.

Baker, G., Gibbons, R. and Murphy, K., 2005, Contracting for control (preliminary and incomplete version).

Bogetoft, P. and Olesen, H., 2002. Ten rules of thumb in contract design: lessons form kanish agriculture, European review of agricultural economics, 29(2), 185-204.

Cré mer, J., Garicano, L. and Prat, A. 2004. Codes in Organizations. CEPR Discussion Paper no. 4205. London, Centre for Economic Policy Research. http://www.cepr.org/pubs/dps/DP4205.asp.

ERS/USDA, 2006. Agricultural contracting update: contracts in 2003, *Economic Information Bulletin Number 9*, Washington: ERS/USDA.

Goodhue, R., 1999. Input control in agricultural production contracts, *American Journal of Agricultural Economics*. 81, 616-620.

Goodhue, R., 2000. Broiler production contracts as a multi-agent problem: common risk, incentives and heterogeneity, *American Journal of Agricultural Economics*. 81, 616-620.

Goodhue, R. 1997. Production control and production contracts: why do integrators control inputs? Presented at *Western Agricultural Economics Association 1997 Annual meeting*,Neno/Sparks, Nevada.

Klein, B., Murphy, K., 1988. Vertical restraints as contract enforcement mechanisms, *Journal of law and Economics*, 31, 265-297.

Knoeber, C., 1989. A real game of chicken: contracts, tournaments, and the production of broilers, *Journal of Law, Economics, and Organization*, 5(2), 271-292

Hart, O., 2001. Norms and the theory of the firm. in E. Brousseau and J. Glachant, eds. *The Economics of Contract in Prospect and Retrospect*. Cambridge: Cambridge University press.

Hart, O. and Moore, J., 1990. Property rights and the nature of the firm, *The Journal of Political Economy*, 98 (6), 1119-1158.

Hennessy, D., 1996. Information asymmetry as a reason for food industry vertical integration, *American Journal of Agricultural Economics*. 78, 1034-1043.

Hueth, B. and Ligon, E., Producer prick risk and quality measurement, *American Journal of Agricultural Economics*. 81, 512-524.

Hueth, B., Ligon, E., Wolf, S. AND Wu, S., 1999. Incentive instruments in fruit and vegetable contracts: input control, monitoring, measuring and price risk, *Review of Agricultural Economics*, 21, 374-389.

Lerner, J. and Merges, R., 1998. The control of technology alliances: an empirical analysis of the biotechnology industry, *Journal of Industrial Economics*, 46, 126-156.

Masten, S. and Saussier, S., 2000. Econometrics of Contracts: An Assessment of Developments in the Empirical Literature on Contracting. *Revue d'Economie Industrielle* **0**(92): 215-36

Reimer, J. Vertical Integration in the pork industry, *American Journal of Agricultural Economics*. 88, 234-248.

Sykuta, M. and Parcell, P., 2002. Contract Structure and design in identity preserved soybean production, CORI working paper no. 2002-01, available online at http://cori.missouri.edu/wps

Tadelis, S., 2002. Complexity, Felxibility and the Make-or-Buy Decision, *the American Economic Review*, 92(2), 433-437.

Vukina, T.,2006, The relationship between contracting and livestock waste pollute, *Review of Agricultural Economics*, 25(1), 66-88.

Simester, D., and Wernerfelt, B., 2005, Determinants of Asset ownership: a study of the carpentry trade, the Review of Economics and Statistics, 87(1), 50-58.