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VERTICAL COORDINATION IN THE CHINESE AGRI-FOOD SYSTEM:

A TRANSACTION COST APPROACH

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Vertical Coordination in the Chinese Agri-Food System: A Transaction Cost Approach

ABSTRACT

There has been closer vertical coordination in agri-food systems not only in advanced market economies but also in developing and transition economies. This study analyses driving forces, determinants and implications of emerging contractual arrangements in the Chinese agri-food system based on the transaction cost approach.

The survey on vegetable growers and processors was conducted in Shandong province, the largest horticultural producing and exporting region in China. The survey data are analysed in terms of logistic regressions and conjoint analysis to identify major factors influencing marketing and procurement channel choice decisions. The study reveals that the increasing contractual arrangements in the Chinese agri-food system have been driven by agricultural transformation, institutional transition and trade liberalization.

The logistic regression models demonstrated that farm specialization and food quality and safety issues are major factors influencing farmers' marketing channel choice. Farm specialization may lead to the increase in risk and dependence of the specialized farms. The specialized farms, in turn, tend to seeking farm services and avoiding price risk by selling their vegetables directly to food processors at the expense of their declining bargaining power against food processors.

The conjoint analysis confirmed that transaction costs arising from hold-up and traceability prevented food processors from using open spot market and wholesale market in the context of small operational scale of family farms and increasingly concerns for food quality and safety. Food processors prefer dealing with larger commercial farms for lower transaction costs while assuring food quality and safety.

The implications for further market-oriented reforms, bargaining power balance, and government's roles in the transition economies are explored. The study suggests that transition economies should pay more attentions to the missing or inappropriate market institutions and infrastructure in order to reduce transaction costs and to raise economic efficiencies. Further study on vertical coordination mechanisms in the context of very small scale of family farms and high standard of food quality assurance is need.

Keywords: Vertical Coordination; Transaction Costs; Agri-Food System; China

STATEMENT OF AUTHORSHIP

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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1. INTRODUCTION

1.1 Changing Vertical Coordination

Since the 1990s, changing vertical coordination in agri-food systems has been widely observed not only in advanced market economies but also in developing and transition economies. Potentially having significant impacts on income distribution and rural development, the issues of vertical coordination in agri-food systems have attracted substantial attentions from a variety of researchers (e.g. Urban 1991; Barry et al. 1992; Barkema 1994; Henderson 1994; Sporleder 1994; Boehlje 1995; Fulton and Gillespie 1995; Kliebenstein and Lawrence 1995; Royer and Rogers 1998; Galizzi and Venturini 1999; Reardon and Barrett 2000; Trienekens and Zuurbier 2000).

Vertical coordination is alignment of direction and control across successive stages of a production and/or marketing system (King 1992). There is a variety of mechanisms to coordinate the vertically interdependent business activities. These alternative mechanisms can be ranked into a spectrum, ranging from spot market at one extreme, through contractual arrangements, joint ventures, networks, strategic alliances, to vertical integration at the other extreme (Mighell and Jones 1963; Hobbs and Young 2001; Peterson et al. 2001).

Contractual arrangements are intermediate forms of vertical coordination. By means of contractual arrangements, the integrators may assume some degree of control over their trading partners. Contractual arrangements can be further classified into market-specification contracts, production-management contracts, and resource-providing contracts at ascendant degree of control (Mighell and Jones 1963).

The economic agents may choose from alternative mechanisms to coordinate their transactions. They may shift their adopted coordination mechanisms in response to the changes in institutional and business environment. By changing vertical coordination, here we mean the economic agents shift their adopted coordination mechanisms from one to another, such as, moving away from spot market to contractual arrangements.

In advanced market economies, such as USA, vertical relationships in agri-food system were coordinated traditionally by spot market. In several agri-food industries, however, the vertical coordination has been shifted to the contractual arrangements, cooperative arrangements, or even vertical integration. Such change in transactional arrangements occurred in the U.S. broiler industry as early as in the 1950s. It also emerged in the U.S. pork industry (Hurt 1994; Boehlje 1995; Fulton and Gillespie 1995; Kliebenstein and Lawrence 1995; Martinez 1999). Although still limited to several agri-food industries, in general, contract production and vertical integration have increased steadily over the last 50 years in the United States. This kind of organizational arrangements has totally covered the broiler industry, dominated pork, dairy, eggs, sugar crops, potatoes, and horticultural industries (Cramer et al. 2001, pp.28-29).

In transition economies, such as China, agri-food system was coordinated traditionally by the administrative means similar to vertically integrated structures. Since the market-oriented reforms, the administrative means have been gradually replaced by market mechanisms. The business units over the successive stages of food supply chains have been turned into independent operational entities. The agri-food system has been increasingly coordinated by various contractual arrangements rather than by open spot market (Niu 1997a).

The changing vertical coordination in agri-food systems raises the questions of why the economic agents shift towards close vertical coordination. What are the driving forces for this trend? What are the major determinants behind these changes? And what are the consequences or implications for the industry stakeholders and policy makers?

The changing vertical coordination in China has occurred in the context of agricultural transformation, institutional transition and trade liberalization: agricultural transformation is ongoing; missing market institutions and infrastructure are quite common; commercial contracts are difficult to be enforced; property rights are poorly defined; small farms are the dominant forms of agricultural organization; and agricultural market is getting increasingly open to the world. This context is in sharp contrast with that in advanced market economies, where agri-food systems are highly commercialized and consolidated, and operate in a relatively perfect legal enforcement environment. The context is also significantly different from that in Russia, where agricultural transformation has evolved into the late stage and the operational scale of farms and off-farm business is quite large.

In such specific context of economic development and institutional transition, the major driving forces, dominant determinants, and particularly policy implications of closer vertical coordination in the agri-food system could be different from those in advanced market economies. However, these questions are not well understood and neglected by the literature. The objective of this study is to explore the specific regularities of organization of agri-food system in developing and transition economies in the context of increasing agricultural transformation and trade liberalization by taking China as a case study.

1.2 Significance of the Research

There are extensive theoretical and empirical studies on vertical coordination. Two separate literatures occurred in the field of agricultural economics and management. The first one emerged as early as in the 1950s and 1960s, when contract production and vertical integration became popular in the U.S. broiler industry and other agri-food sectors (Davis 1957; Butz 1958; Mighell and Jones 1963). This early literature claimed that the driving forces of contract production and vertical integration came from technological advance and agricultural commercialization, which prevailed in the United States and other developed countries at that time. The new technologies were characterized with relatively larger minimum efficient scales, and their application required larger physical and human capital. This imposed higher technical, financial and market risks on the participants of agri-food systems, particularly on small farmers. Contract production and vertical integration can stabilize the capacity utilization of agribusiness, diversify the risk and uncertainty, and facilitate the small farmers' access to capital, managerial skills and farm services.

The second literature on vertical coordination emerged in the 1990s when agroindustrialization and food supply chain management attracted the attentions of agricultural economics and management researchers. In a variety of agri-food industries in both developed and developing countries, vertical coordination has shifted away from open spot market toward contractual arrangements, joint ventures and strategic alliances. Some researchers claimed that recently closer vertical coordination was caused by increasing concentration in agri-food industries, and the economic agents were motivated to pursue extra monopoly profits (Cotterill 2001). Other researchers

addressed vertical coordination issues from the perspective of new institutional economics (Frank and Henderson 1992; Hobbs 1997; Martinez et al. 1998). This approach hypothesizes that the economic agents choose from alternative governance structures in order to economize on transaction costs (Williamson 1985). Transaction costs may be changed by technological innovations, by consumer preference shifts, or by changes in legal regulations. Closer vertical coordination was favoured recently by the economic agents, indicating that open spot market turned out to be a relatively expensive option in the existing context.

In transition economies, transaction costs are extremely important factors for the organization of agri-food systems because of prevailing market imperfections and backward infrastructure. Many researchers suggested that more efforts are needed to reduce transaction costs associated with broadening markets and enforcing contracts to improve performance of agriculture in transition countries (Gaisford et al. 2001). The contract innovation through private ordering was also proved an effective way in less enforceable legal environment (Gow et al. 2000). In addition, marketing cooperatives were recommended to improve bargaining powers of small farmers and to facilitate small farmers' access to farm services (Deininger 1995).

More recently, the implications of food quality and safety issues for the organization of agri-food system have been discussed (Caswell and Mojduszka 1996; Hennessy 1996; Unnevehr and Jensen 1996; Caswell et al. 1998; Unnevehr et al. 1999; Zago 1999; Ziggers and Trienekens 1999; Farina and Reardon 2000; Unnevehr 2000; Boger 2001; Henson and Hooker 2001; Kilmer et al. 2001; Reardon et al. 2001; Sporleder and Goldsmith 2001). Producing, exporting horticultural and livestock products provide

potential opportunities for the developing countries to gain from trade liberalization. However, it was challenged by food quality and safety issues. The increasing concerns about food quality and safety, and then tougher legal regulations on food safety, grades and standards in developed countries, have created significant market access barriers to the developing countries. In response to this situation, public regulations and business strategies in developing countries have experienced dramatic changes, leading to the changes in vertical coordination in agri-food industries to save transaction costs and to improve international competitiveness.

The agri-food system, particularly the horticultural and livestock sectors in China, has experienced significant institutional and organizational changes since the 1990s. Contractual arrangements have become a quite popular means of coordination. This change in vertical coordination occurred under the context of increasing agricultural transformation, institutional transition, and trade liberalization. Small farmers in China faced serious transactional difficulties during the transitional period, which was further exacerbated by the issues of food quality and safety (e.g. the case of pesticide residues in spinach). Subsequent public and business reactions and implications are profound for the organization of Chinese agri-food system. However, there has been little study on these issues yet. This study relates contractual arrangements emerging in the Chinese agri-food system, to the increasing agricultural transformation and trade liberalization. The study aims to understand the specific regularities of agricultural organization in the developing and transition countries.

China is an excellent case to study the changing vertical coordination in agri-food systems. Firstly, China is the largest transition economy in the world, which adopted

the gradualist approach to market economy, not "shock therapy" as other transition economies (Zhao 1999). The gradualist approach succeeded in avoiding potential social and economic instability, however, many other issues remain unresolved, including land tenure system and food marketing deregulation. This dynamic institutional environment may influence the organization of agri-food system.

Secondly, China is the largest developing country in the world. Due to high economic growth, fast industrialization, and accelerating urbanization over the last two decades, macroeconomic environment in China has been changed dramatically. Its pattern of comparative advantage has been also shifted away from agriculture toward labour-intensive manufacturing industries. Transformation of Chinese agriculture has been accelerated from a traditional and subsistence system to a commercial and modern system. However, agricultural transformation in China is not finished yet. There are still 900 millions of rural residents, 200 million family farms with only 0.5 hectare of arable land on average per household. These conditions may also have important implications for the agricultural and rural economic organization.

Thirdly, China is an important player in the world market. Chinese agri-food system contributes directly to food security of 21 percent of world population with only 7 percent of world arable land. Undoubtedly, any significant change in this system could have substantial impacts on both China's domestic market and world food market. Over the last several years, the horticultural industry in China was developed into one of the largest horticultural sectors in the world. China's horticultural exports continue to rise in the near future. Recent changes in regulations and business organizational innovations may influence the competitiveness of the Chinese agri-food system.

1.3 Research Questions

1.3.1 What Are the Driving Forces?

Some researchers claimed that increased concentration and consolidation has induced recently closer vertical coordination in agri-food systems (Boehlje 1999; Cotterill 2001). Other researchers argued that recently closer vertical coordination has been driven: (1) by technological advances, especially in communication, transportation, information and modern biotechnology; (2) by shifts in consumer preferences toward higher quality, safer and differentiated food products; (3) by enhanced legal regulations related to the food safety, grades and standards, and environment; and (4) by competition strategies of firms in the context of economic globalization (Hobbs and Young 2001).

However, the fact of low market concentration (Sang 1996) and slow technological progress in the Chinese agri-food system seems to rule out the reasons from both market structure and technological aspects. Then, what has caused recently changing vertical coordination in China?

This study identifies three factors as major driving forces of recently closer vertical coordination in China. The fundamental driving force comes from the increasing agricultural transformation, which has been pushed by high economic growth during the last two decades. Agricultural commercialization and farm specialization are the major features of agricultural transformation at current development stage of China.

The second driving force is from the institutional transition, which triggered the agricultural commercialization process since the 1980s and provided the institutional

pre-condition for quicker agricultural transformation. As the joint results of agricultural transformation and the institutional transition, more than 200 million small family farms have been established, and about 90 percent of agricultural production in China are commercialized. Consequently, Chinese farmers become increasingly dependent on market exchanges than ever before, particularly in the horticultural and livestock sectors. However, using price mechanism incurs costs, and the costs are particularly high in transition economies due to missing market institutions and infrastructure. In response to this situation, organizational innovations have emerged to reduce transaction costs. Just as new institutional economics suggests, if the economic agents obtain the freedom to choose from alternative coordination mechanisms, the inefficient governance structures will be eliminated (Menard 2000).

The third driving force is from trade liberalization. Under the context of globalisation, the changes in consumer preferences and legal regulations in exporting countries can easily affect domestic production. The horticultural and livestock sectors in developing countries are potentially competitive sectors based on their resource endowments, but this was challenged by the recent food quality and safety issues (Unnevehr 2000). The food quality and safety issues have deeply affected the horticultural and livestock sectors in China either—the two heavily invested agri-food industries since the end of 1990s. The government has enhanced the legal regulations and administration of food quality and safety, and agribusiness firms have been also encouraged to adopt the quality control and certification systems, such as hazard analysis critical control point (HACCP) and ISO 9000. The implications for the organization of agri-food system are significant.

1.3.2 What Are the Determinants?

Several alternative arguments for vertical coordination can be found in the literature, such as, the market failure arguments, the transaction cost arguments, and the competence-based arguments. The market failure arguments focused on market concentration, market externalities and asymmetric information (Perry 1989). The transaction cost arguments focused on imperfect information, specific assets and transaction costs (Williamson 1971, 1979). The competence-based arguments focused on firm competences or capabilities, learning process and strategic management (Teece 1986; Langlois and Robertson 1989; Foss 1993; Boon 1999).

The market failure arguments may be relevant to explain the evolving vertical coordination in advanced market economies, such as U.S. where significant evidences of increased market concentration and consolidation have been found in many agri-food industries. However, the transaction cost arguments may be more relevant to explain recently changing vertical coordination in transition economies, where transaction costs in information, negotiation, and enforcement are very high relative to the advanced market economies. The competence-based arguments may be also helpful to address the issues of changing vertical organization in transition economies, where both market capabilities and firm capabilities evolve dramatically during the transition period.

This study is mainly based on the transaction cost approach, but it takes into consideration of the specific situations in the Chinese agri-food system, and then test our transaction costs based arguments by a case study of the shifting marketing and supply channels in the vegetable industry in China.

1.3.3 What Are the Implications?

The changing vertical coordination raises concerns about its impacts on market competition and bargaining power balance. The early studies indicated that closer vertical coordination might lead to "thinner market". The potential implications of market competition may be particularly important for China, because it adopted a gradualist approach to market-oriented reform, the price discovery system has not been well-established, and the Chinese agri-food system has not been totally liberalized yet.

The changing vertical coordination may have significant effects on income distribution and welfare. The issue of bargaining power balance between food processors and small farmers is particularly challenging to China, where average farm size is among the smallest in the world. There is no real farm cooperatives or farmer unions to help these small farmers. Small farmers' bargaining power in transactions is very weak. Moreover, taking into consideration of miserable failure of the collective farming system in China, marketing cooperatives may be much more difficult to be effectively established there.

The challenging task facing policy makers is how to create a favourable policy environment for the economic agents to deal with expensive transaction costs arising from small operational scale, missing market institutions and infrastructure, and the issues of food quality and safety. The government should make strategic decision on how to save transaction costs: simply encourage private firms to adopt closer coordination mechanisms or make efforts to improve the market capabilities? Some researchers claimed that closer vertical coordination may benefit the international competitiveness, but the links may be more complicated.

1.4 Approach and Methodology

Vertical coordination has been always a multidisciplinary research field because it situated at the intersection of the theory of the firm, the theory of contract, and the theory of market (Perry 1989). There are three major theoretical approaches to vertical coordination, including the neoclassical approach from industrial organization theory, the transaction cost approach from new institutional economics, and the competence-based approach from the business strategy literature.

At the early stage, vertical coordination literature was dominated by the neoclassical approach, which focused on vertical integration and make-or-buy decision. This strand of the literature was an extension of horizontal market analysis by industrial organization theory to determine whether market power can be transferred via integration to neighbouring stages in a market channel, or whether vertical integration raises entry barriers and creates market power in one or both industries (Cotterill 2001).

The neoclassical approach argues that market concentration, market externalities and asymmetric information are the fundamental reasons of vertical integration. Market concentration, entry barriers and collusions may induce market power and other anti-competition behaviours. The integrators may take advantage of market failures to exploit monopoly profits by internalizing monopoly inefficiencies, by extracting inframarginal rents, or by imposing price discrimination (Perry 1989).

From the 1970s, the transaction cost approach began to dominate vertical coordination literature as increasing scholars recognized the essential roles of transaction costs in economic organization. The transaction cost approach argues that imperfect

information, specific assets, and transaction costs are the fundamental reasons for vertical coordination (Williamson 1971, 1979). If transaction costs are zero, then the organization of economic activities is irrelevant, because the use of resources will be similar, no matter how production and exchange activities are arranged, and any advantages one mode of organization appears to hold over another will simply be eliminated by the costless contracting (Williamson 1979).

Transaction costs arise from combination of market uncertainty, transaction-specific investments, and human behaviours of bounded rationality and opportunism (Williamson 1979, 1985). Internalizing the transaction or vertical integration can save these costs. However, internalization strategy will incur management costs. Therefore, the economic agents have to balance a trade-off between transaction costs and management costs to achieve better economic results in terms of choice of alternative coordination mechanisms.

Different from both the neoclassical approach and the transaction cost approach, the competence-based approach based on the evolutionary framework and assumed firm heterogeneity. This approach argues that firm competences or capabilities are the key determinants of firm boundaries. The firm boundaries should be understood not only in terms of transaction costs but also in terms of learning, path dependence, technological opportunities, selection, and complementary assets (Dosi 1994; Langlois and Robertson 1995; Foss and Knudsen 1996; Foss 1997).

The above alternative theoretical approaches allow us to investigate the changing vertical coordination from different perspectives. However, appropriate approach depends on the purpose of the research and the context of research subject. The

research subject of this study is the emerging contractual arrangements in the Chinese agri-food system. China's evolving business and institutional environment suggests that the transaction cost approach may be the most suitable approach, because it addresses institutions and transaction costs, which are probably the major causes of the increasing contractual arrangements in the Chinese agri-food system.

This study pays attention to the trade-off between transaction costs and farm specialization, which evolves dramatically during the process of agricultural transformation, and believes that there exists interactions between vertical coordination and farm specialization. That is to say, the transaction costs in the process of agricultural transformation are dynamic, agricultural organization therefore has to reflect these changes. We empirically test this transaction cost-based argument in terms of the vegetable industry in China.

In order to approve that transaction costs are the major determinants of recently changing vertical coordination in the Chinese agri-food system, Logit regression models and conjoint analysis have been used. For these empirical studies, the survey on vegetable farmers and processors has been conducted in Laiyang City, Shandong Province of China. More specifically, the study analyzes the major determinants of marketing channel choice by vegetable growers to demonstrate how farm specialization and food quality inspection have induced the changes in transaction costs and then influenced farmer's marketing channel choice decision. Based on the survey data on food processors, conjoint analysis has been conducted to determine the major factors influencing procurement channel choice by food processors under the situations of emerging food quality and safety issues.

1.5 Structure of the Thesis

This thesis consisted of six chapters. Chapter 2 critically reviews the alternative theoretical approaches to vertical coordination to justify the adoption of the transaction cost approach in this study, and describes the analytical framework for this study. Chapter 3 describes the context of closer vertical coordination, identifies the major driving forces of changing vertical coordination, and analyses fundamental reasons of this trend. Chapter 4 examines the dominant determinants of marketing channel choice by vegetable growers based on the Logit regression models. Chapter 5 analyses the major influential factors of supply channel choice by food processors with conjoint analysis. Chapter 6 at first discusses the implications of changing vertical coordination for the transition and vertical organization of agri-food systems in the condition of small family farm system, for public and private actions on food quality and safety issues, then concludes the thesis with the principal findings in this study.

2. THEORETICAL APPROACHES TO VERTICAL COORDINATION

2.1 Introduction

The determinants, mechanisms and implications of vertical coordination have been discussed by researchers based on the different theories of the firm. The advance in the theories of the firm during the last three decades has greatly contributed to the knowledge of economic organization and vertical coordination. There are three major theoretical approaches to vertical coordination. The first approach is the neoclassical approach from industrial organization theory, which adopts the production function theory of the firm. The second approach is the transaction cost approach from new institutional economics, which adopts the transaction cost theory of the firm. The third approach is the competence-based approach from the business strategy literature, which adopts the competence-based theory of the firm.

This chapter critically reviews these approaches to understand the evolution of the literature on vertical coordination, and justify the approach adopted in this study. Section 2 introduces the industry life cycle model by Stigler as a starting point, because this model was an early study of vertical integration, which adopted the perfect competition framework. Then, perfect competition assumptions have been relaxed step by step. It has been firstly relaxed by industrial organization theory by recognising the existence of market power and externalities. Section 3 discusses forward integration model, backward integration model, and integration of successive monopolies. The assumption of perfect information with the neoclassical framework has been further relaxed by new institutional economics, which brought about profound impacts on the theory of economic organization. Section 4 examines the literature on vertical

coordination from the perspective of transaction cost economics. The agency theory assumes asymmetric information and risk aversion. Section 5 briefly introduces this branch of new institutional economics, and discusses the integration of the agency theory with the transaction cost approach. Both the neoclassical approach and the transaction cost approach have been challenged by the recent trend of outsourcing, networks, and strategic alliances. Section six overviews the newly developed competence-based approach, which addresses the competence and capabilities of the firm. The last section justifies why the transaction cost approach is adopted, and describes the analytical framework for this study.

2.2 The Stigler Model

2.2.1 The Stigler Model

Stigler proposed the industry life cycle model to explain the variation of vertical integration in different industries in his classic 1951 paper. His work was based on Adam Smith's famous theorem that "the division of labour is limited by the extent of the market". The model suggested that: (a) vertical integration would be extensive in infant industries, because the production quantity at any stage of the multiprocess product is too small to support a specialized firm or an intermediate market; (b) vertical disintegration would be the typical development in growing industries, because firms will spin off the production stages subject to increasing returns to scale in response to the market growth; and (c) vertical integration would emerge in declining industries again, because the related subsidiary, auxiliary, and complementary industries would disappear with shrinking market, the surviving firms have to take over those functions

formerly performed by the independent firms (Stigler 1951).

The life cycle effects were demonstrated by reference to a multiprocess final product. To produce a multiprocess final product, the firm has to engage in a series of distinct operations, each operation involves a separable technology and a corresponding distinct cost curve. These cost curves may be decreasing continuously, increasing continuously, or U-shaped. The possible cost relationship between the operations are ignored. Thus, a separate cost curve for each operation can be derived as the function of its own output. Furthermore, a constant proportion between the rate of output of each operation and the rate of output of the final product are assumed, so that the vertical sum of the costs of various operations is the firm's average cost curve. The continuously declining average costs for certain operations indicate that these operations are subject to increasing returns to scale. This raises a question, if market is perfectly competitive, why firms do not further exploit these increasing returns to scale, or why firms do not abandon these operations to allow other firms to specialize in these functions to take full advantage of increasing returns. The arguments by Stigler were as follows: when an industry is at its infant stage, it does not pay for a firm to specialize in a particular operation even if this operation is subject to increasing returns to scale, because "These functions may be too small to support a specialized firm or firms; the sales of the product may be too small to support a specialized merchant; the output of a by-product may be too small to support a specialized fabricator; the demand for market information may be too small to support a trade journal" (Stigler 1951).

However, as the industry expands with market growth, it may become profitable for a firm to specialize in the operation subject to increasing returns to scale. At first, there

would be a monopoly in this operation, but with continued demand growth, oligopoly and then competition would arise. The growth of market demand can trigger specialization and disintegration. Finally, as the industry matures further, the newly developed products from other industries may substitute the demand for this industry, consequently, it may result in the decline of this industry, as well as the related subsidiary, auxiliary, and complementary industries. At this time, the surviving firms have to take over those functions, which are no longer carried on at a rate sufficient to support independent firms.

2.2.2 Empirical Tests and Limitations

1. Empirical Tests

The Stigler model was empirically tested by several studies, but the results were mixed. (Stigler 1951) suggested the ratio of value-added to sales as a crude index of the extent of vertical integration within establishments. He cited the data to show the declining vertical integration in manufacturing industries. (Tucker and Wilder 1977) examined the data of 54 manufacturing firms at both the firm level and the industry level, using an adjusted value-added to sales ratio, and found a U-shaped relationship between vertical integration and the firm age. If the firm age can represent the industry age, then, this result supports Stigler's hypothesis. (Levy 1984) analysed the census data for 38 manufacturing industries from 1963, 1967, and 1972, and found that the demand growth (measured as the ratio of current to past sales) and vertical integration (measured as the ratio of value-added to sales) was significantly and positively correlated. If we believe young industries are growing quicker than mature industries, then, this result is consistent with Stigler's hypothesis. (Demsetz 1988b) studied the

annual COMPUSTAT data from 1962-81 and US census data for 1963-77, and found that only market size possibly has explanatory power of vertical integration.

On the other hand, (Adelman 1955) found the "apparent rough correlation" between vertical integration and firm size, which he claimed was contrary to Stigler's hypothesis. (Stuckey 1983) argued that the increased forward integration by aluminium refiners into fabrication during 1955-78 is inconsistent with Stigler's hypothesis with the general growth of aluminium market. (Langlois and Robertson 1995) claimed that "the automobile industry is a potential counterexample: firms were quite differentiated at an early stage in the industry's life but became much more integrated as output expanded".

2. Limitations

The Stigler model identified the extent of market as an important determinant of vertical integration. However, the extent of market is only a part of the story of vertical integration, other forces are also at work, as Stigler admitted. (Cotterill 2001) claimed that other forces in total might be more important than the industry life cycle effects.

Firstly, the Stigler model discussed how and when the division of labour occurs along a chain of production based on the perfect competition framework. If the perfect competition assumption is relaxed, for example, assuming the existence of monopoly in intermediate product market, how about the Stigler hypothesis? In his 1951 article, Stigler also recognized that monopoly and public regulations are the sources of market imperfections, which may hinder the division of labor and specialization. That is to say, market imperfections are important offsetting forces against specialization. (Elberfeld 2002) demonstrates that, if the entry into the intermediate markets is free and the firms

compete, the Stigler hypothesis holds. Otherwise, if the entry into the intermediate markets is restricted, or intermediate producers collude, the Stigler hypothesis does not hold. In contrary, vertical integration maybe increases with the market growth.

Secondly, the Stigler model focused only on one of the external conditions of the firm, while neglected the internal conditions of the firm, particularly the technological innovation within the firm. The model recognized the scale economies as the original drivers of specialization. However, the scale economies are always changing along with the technological innovations. (Lewis and Sappington 1991) claimed that those technological changes that can reduce costs significantly or need to employ more highly skilled labours are more likely to lead the firms to integrate vertically, instead of subcontracting. (Langlois and Robertson 1995) also claimed that different technological innovations might have different effects on vertical integration. The autonomous innovation affects only one stage in a chain of production. It may stimulate specialization and vertical disintegration, as predicted by the Stigler model. However, the systemic innovation needs more coordination across the stages of production to facilitate technical cooperation, which may trigger vertical integration instead of disintegration.

Thirdly, the division of labor can improve productivity, but it requires transactions as precondition. Transactions do not occur in a frictionless vacuum, they incur transaction costs (Coase 1937). That is to say, there exist a trade-off between the economies of specialization and transaction costs (Yang and Ng 1993). The transactional hazards can be serious issues in a highly uncertain business environment. In such context, vertical integration holds advantage. It can avoid the transactional hazards from procurement

outside, and save transaction costs (Williamson 1975). From this perspective, vertical disintegration is also subject to transaction costs, in addition to the extent of market.

2.3 The Neoclassical Approach

The perfect competition framework, on which the Stigler model is based, was relaxed by the neoclassical approach. The neoclassical approach examined vertical integration (make-or-buy decision issues) by explicitly assuming the existence of imperfect competition and market externalities. The main purpose of this literature is to determine whether market power can be transferred to the successive industries via vertical integration, leading to price distortions and negative welfare effects (Cotterill 2001). The literature focused on equilibrium price and output, welfare implications and antitrust policy suggestions. The traditional paradigm of this approach was the structure-conduct-performance (SCP), which advanced that the structural characteristics of an industry strongly influence the conduct of firms, which, in turn, influences the market performance. Since the 1970s, the focal point of the literature has shifted to the game-theoretical models (Tirole 1988, pp.2-3).

According to the neoclassical literature, there are three kinds of market imperfections that may induce the firms to integrate vertically: imperfect competition, market externalities, and asymmetric information. If market competition is imperfect, several incentives may arise for the imperfectly competitive firms to integrate into the adjacent competitive stages. These incentives include: (1) to internalize the efficiency losses (monopoly or monopsony inefficiencies) from the imperfect competitive behaviours; (2) to extract inframarginal rents from the competitive stage by "thinning" open market

or through partial integration; and (3) to impose price discrimination within the competitive stage while circumventing the government regulations (Perry 1989).

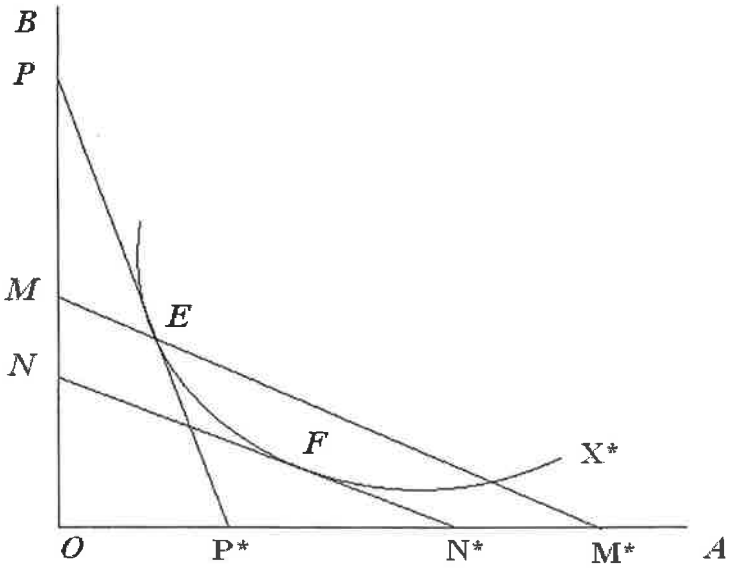
The welfare implications of vertical integration for consumers, producers and society are always controversial in the neoclassical literature. Some researchers claimed that, vertical integration, along with other kind of structural changes such as market concentration, consolidation and horizontal integration, could lead to potential abuse of market power; more serious entry barriers by increasing the necessary capital and knowledge; and higher costs for the competitors through "thinning" open market or even market foreclosure (Stigler 1951; Bain 1956; Salop and Scheffman 1983). While other researchers argued that vertical integration is not so harmful as horizontal integration (Spengler 1950). Following three models were used to demonstrate the incentives, effects and implications of vertical integration by the neoclassical literature.

2.3.1 Forward Integration Model

Forward integration model demonstrates that an input monopolist has the incentives to integrate into its downstream industry in order to internalize the deadweight efficiency losses when the downstream firm adopts a variable-proportion production technology (McKenzie 1951; Vernon and Graham 1971; Perry 1989). The model assumes that the upstream firm is a monopolist, while the downstream firm is a competitive firm, and that the downstream firm uses the upstream monopolists' product in variable proportions with other intermediate inputs. For the purpose of profit maximization, the downstream firm may substitute away from the monopolized inputs toward the other competitive inputs, which results in the efficiency losses due to the relative price distortion. If the upstream monopolist integrates into the downstream firm, and then

increases the employment of originally monopolized inputs to the efficient level, the efficiency losses due to over-substitution could be eliminated and changed into the profits of the integrated firm.

Figure 2. 1 Forward Integration into a Downstream Firm



Source: Vernon and Graham 1971

We can see this incentive clearly from Figure 2.1 above. Suppose both input A and input B are necessary to produce X. If input A is monopolized by an upstream firm, the price ratio of input A to input B will rise, hence, a downstream firm will use less input A and more input B. The optimal input combination to produce X* will move from F to E. However, if the upstream monopolist vertically mergers the downstream firm, the optimal input combination to produce X* for this integrated firm will move back to F. The iso-cost curve of the integrated firm will shift from MM* to NN*, and the profit of the integrated firm will increase by at least MN.

Forward integration model can be used to show the incentives for the firms to impose

price discrimination in a competitive downstream industry either (Wallace 1937; Stigler 1951; Perry 1989). For this purpose, the model assumes that an input monopolist faces two downstream competitive firms: one firm with elastic demand and another firm with inelastic demand for this monopolized input. If the upstream monopolist fully integrates both of two downstream firms, the integrated firm can reduce the input employment in the subsidiary with inelastic demand, and expand the input employment in the subsidiary with elastic demand. This purpose can be achieved by integrating into only the downstream firm with elastic demand, and then by raising the monopoly price to the downstream firm with inelastic demand.

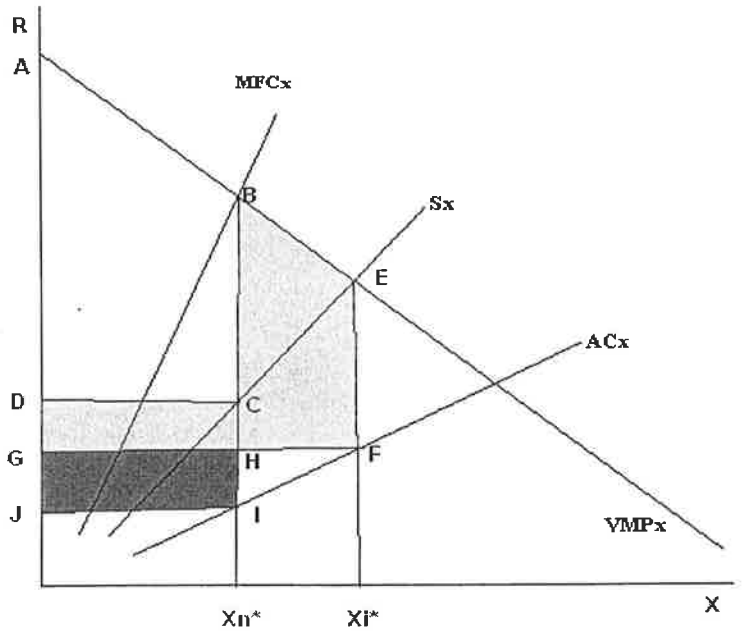
2.3.2 Backward Integration Model

Backward integration model demonstrates that a monopsonist may have the incentives to integrate back into an upstream industry (McGee and Bassett 1976; Perry 1978). The model assumes that an upstream industry is competitive, and a downstream firm is a monopsonist, which faces the rising supply price of the inputs. The monopsonist firm may employ too little raw materials from this upstream industry. This distortion could be eliminated when the monopsonist integrates backwards into the upstream industry.

Following the exposition by Royer (1998, pp.88-93), the model assumes that a downstream monopsonist buys input X from a competitive upstream industry at a rising price R=$R(x)$, then sells the final product in a perfectly competitive market at constant price p. The monopsonist's production function is $q=q(x)$, characterized with $dq/dx>0$ and $d^2q/dx^2<0$. Whereas, the upstream industry cost function $C(x)$ is characterized with $dC/dx>0$ and $d^2C/dx^2>0$. Based on these assumptions, the monopsonist's maximum profit without vertical integration would be π_N^* (area of ABCD in Figure 2.2

and Equation 2-1). If this monopsonist integrates backward into the whole upstream industry of X, then, its maximum profit would be π_I^* (area of ABEFHG in Figure 2.2 and Equation 2-2). The difference between π_I^* and π^*_N is the area of DCBEFHG in Figure 2-2, which is positive. This means that the monopsonist has the incentives to integrate backward into the upstream industry of X, if the set-up costs, acquisition costs and higher internal bureaucratic costs are ignored.

Figure 2. 2 Backward Integration with a Monopsonist



Source: Royer 1998

The costs of acquiring the firms of the upstream industry under competitive condition would equal the combined profits of the upstream industry without vertical integration π_S^* (Equation 2-3). If we consider these acquiring costs, the net benefits of complete backward integration would be $\pi^* = \pi_I^* - \pi_N^* - \pi_S^*$, the area of BEFH minus GHIJ in Figure 2.2 and Equation 2-4. This result could be positive or negative, depending on the

monopsonist's production function, its demand function, as well as the cost function of the upstream industry.

$$\pi^*_N = \int_0^{x_N^*} p\frac{dq}{dx}dx - \frac{dC}{dx}\Big|_{x^*_N} x^*_N \qquad 2\text{-}1$$

$$\pi_I^* = \int_0^{x_I^*} p\frac{dq}{dx}dx - C(x_I^*) \qquad 2\text{-}2$$

$$\pi_S^* = \frac{dC}{dx}\Big|_{x_N^*} x_N^* - C(x_N^*) \qquad 2\text{-}3$$

$$\pi^* = \int_{x_N^*}^{x_I^*} p\frac{dq}{dx}dx - C(x_I^*) + C(x_N^*) \qquad 2\text{-}4$$

Perry (1978) suggested that there are more incentives for partial backward integration. During partial integration, the monopsonist can extract some of the rents by acquiring the suppliers one at a time. The integrated firm then increase the production of its subsidiaries in the upstream industry, and reduce the purchase from the remaining independent suppliers of the industry. As a result, the price in open market may decrease. Then, the monopsonist can further merger more suppliers at a lower expense.

Love and Burton (1999) also agreed that partial integration could increase profit through production efficiency gains and through a lower price for externally purchased input. They claimed that optimal degree of backward integration is achieved when the monopsonist's profit from exerting monopsony market power in the external spot market equals its profit from producing raw input internally, less the incremental cost of acquiring internal raw input production capacity.

2.3.3 Integration of Successive Monopolies

Spengler (1950) proposed the successive monopoly model to demonstrate that vertical integration is not harmful but beneficial in case of successive monopolies. Under the circumstance of successive monopolies, double marginalisation occurs, consumer price of final product is too high even from the viewpoint of maximizing total monopoly profits (Varian 1996). In contrast, vertical integration of successive monopolies could result in the lower final price, higher output and sales, and net welfare gains.

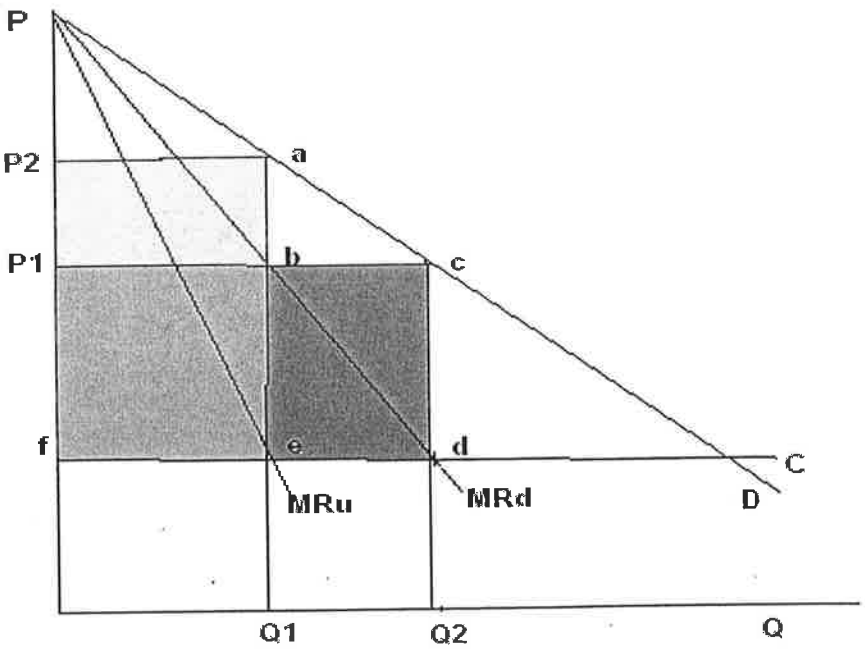
In order to approve this claim, Spengler (1950) referred to a three successive stage of production. If market competition at each stage is perfect, then entrepreneur has no incentive to integrate vertically, because no extra profit can be expected. However, if horizontal integration at each stage becomes significant, each successive stage may impose a surcharge in addition to the necessary profit under perfect competition, double marginalisation occurs. If these successive monopolies are vertically integrated, the final production will increase and the price will decline. Both producers and consumers are better off.

Greenhut and Ohta (1976) formalized the successive monopoly model. They assumed a monopolist input supplier, and a monopolist final producer with fixed-proportion production technology, but without monopsony power. Their model concluded that the merger or collusion between the input supplier and the final producer could bring about lower price, higher output, greater profits to the merged or colluding firm. This conclusion can be shown in Figure 2.3.

Suppose there are two monopoly firms at the successive production stages. The upstream monopolist produces a single product at a constant marginal cost of C, and

sells this product to a downstream firm. The downstream firm uses this monopolized input in fixed-proportion to other intermediates to produce a final product with constant returns to scale. The downstream monopolist faces declining linear demand curve D and the marginal revenue curve MR_d. For the convenience of illustration without loss of generality, the model assumes that the downstream firm produces one unit of the final product from each unit of the monopolized input, and the only variable cost of the downstream firm is the purchase of the monopolized input. Therefore, the marginal cost of the downstream firm is just the price of the monopolized input (P_1). According to the first order condition, the downstream firm maximize its profits when equalizing its marginal revenue to its marginal cost ($MR_d=P_1$). Similarly, the upstream monopolist also maximizes its profits through equalizing its marginal cost (C) to its marginal revenue ($MR_u=C$).

Figure 2. 3 Integration of Successive Monopolies



Source: Cotterill 2001

From Figure 2.3, we can see that the optimal quantity is Q_1, the downstream firm's profit is the area of abp_1p_2, and the upstream firm's profit is the area of $befp_1$. If the two monopolists integrate vertically, the optimal quantity moves to Q_2, the total profits for the vertically integrated firm is the area of p_1bcdef, larger than the total sum of abp_1p_2 and $befp_1$.

2.3.4 Empirical Tests and Limitations

1. Empirical Tests

The neoclassical approach relaxed the perfect competition framework by assuming the existence of market power and market externalities. The literature investigated the make-or-buy decision of the firms and its consequences for market competition and welfare implications, and claimed that the incentives for vertical integration is to earn extra monopoly profits. There are few empirical tests on the neoclassical approach except for some experimental simulations. As for forward integration, Royer and Bhutan(1995 cited in Royer 1998) established a three-stage forward integration model to examine the effects of forward integration by farmer cooperatives. The model includes producers, assemblers (cooperatives, and no cooperatives), and processors. The assemblers face a rising supply curve, whereas the processors face a declining demand curve. The model simulations showed that forward integration by cooperative assemblers might produce higher industry output, lower processed food price, and increased consumer surplus.

Azzam (1996) tested the incentives for backward integration based on the partial integration model proposed by Perry (1978). He set up an empirically implementable model, and applied the model to the U.S. beef slaughter industry. His results seem to

support that backward integration may eliminate the monopsony inefficiency. Love and Burton (1999) also claimed that their comparative statics results are also consistent with the recent studies of the beef packing industry. Durham (2000) experimentally tested the vertical integration of successive monopolies. He assumed that the upstream market has only a single seller; the downstream market consists of one or three firms. If the downstream market has three firms, there is no evidence of vertical externality. However, if the downstream market only has one firm, vertical externality does exist. His experimental results seem to support for Spengler's double marginalisation model.

2. Limitations

The neoclassical approach has dominated the vertical coordination research for several decades, and is still popular in explaining the increasing concentration and consolidation in advanced market economies (Sexton 2000; Cotterill 2001; Sexton and Zhang 2001). In developed countries, production concentrations in farm inputs, food processing, and food distribution industries have increased significantly in the last decades. Taking the United States as an example, there are 47 percent of genomics patents in the hands of leading four multinational firms in 1998 (Lesser 2000). The 100 largest food and tobacco processors accounted for about 75 percent of the value-added in food processing industry in 1997, almost doubled the share from 1954 (Rogers 2001). Six supermarket chains controlled 52.6 percent of supermarket sales (Cotterill 2001). According to the neoclassical approach, the increased concentration can create monopoly and affect the prices. But the recent studies in this field showed that the potential impacts of this trend is not so serious, except for the successive market power at multiple stages of marketing channels (Sexton and Zhang 2001).

The neoclassical approach relaxed the perfect competition assumption by assuming the existence of market power and externalities, and suggested the market failure arguments arising from market concentration, externalities and asymmetric information. However, market failures are more extensive. The imperfect information for the economic agents implies the existence of transaction costs, which could significantly affect the organization of economic activities. The neoclassical approach assumed away transaction costs, and ignored the set-up costs, acquisition costs and any increase in internal bureaucratic costs. This negligence may lead to incorrect prediction of the model.

Secondly, both the Stigler model and the neoclassical approach examined only vertical integration, but cannot properly explain the existence of many hybrid forms of vertical coordination. The extensive existence of intermediate forms of vertical coordination requires that the vertical coordination theory should be able to explain not only the extreme cases, but also the more general cases.

Although the neoclassical literature on vertical integration is somewhat formal, they neglected many important factors, such as the growth of market demand, the technological innovations, and institutional changes. More seriously, this approach is lack of enough empirical tests. This approach is not suitable to explain the changing vertical coordination in the Chinese agri-food system, because there exists little evidence of market concentration in the Chinese agri-food system. Moreover, the dominant coordination mechanism in the Chinese agri-food system is contractual arrangement, not vertical integration.

2.4 The Transaction Cost Approach

2.4.1 Transaction Costs

Both the classical and neoclassical frameworks assume that the economic agents have perfect information. The economic agents can get to know the prices and technologies in order to maximize their utility functions and profit functions without any expense. That is to say, transaction costs are assumed zero in the classical and neoclassical models. However, new institutional economists argues that if transaction costs are really zero, the organization of economic activities is irrelevant, because any use of resources would be similar, no matter how production and exchange activities are arranged (Williamson 1979).

It is Coase who first introduced transaction costs into economic analysis in his classic article "the nature of the firm" in 1937. He argued that in an exchange economy, the resource allocation is coordinated by the price mechanism, and realized through a series of transactions, which incur transaction costs. Coase claimed that the firm and the market is an alternative to coordinate resource allocation. The firm comes into existence because it can save transaction costs. Within the firm, market transactions are eliminated, and the manager's authority replaces price signals. However, coordination of production by the firm also incurs costs—the bureaucratic costs or management costs. Therefore, the trade-off between transaction costs and management costs determines the boundary of the firm. "A firm will tend to expand until the costs of organizing an extra transaction within the firm become equal to the costs of carrying out the same transaction by means of an exchange on the open market or the costs of organizing it in another firm" (Coase 1937).

So far, the concept of transaction costs has not been well defined. There are several versions of the definition of transaction costs. Coase referred transaction costs to the costs of acquiring price information, negotiating, safeguarding, and drafting an agreement in his 1937 paper. These costs were later termed as *ex ante* transaction costs. Williamson, a successive researcher in new institutional economics, emphasized more on the costs of monitoring, settling disputes, renegotiating, arbitration and litigation. He termed these costs as *ex post* transaction costs (Williamson 1985, pp.20-22).

Demsetz suggested that the costs should be classified into transaction costs and management costs in order to interpret Coase in a manner consistent with his objective. The former refers to the costs of organizing resources across the market, and the latter refers to the costs of organizing resources within the firm. Transaction costs should be interpreted as those of any activity undertaken to use the price system, while management costs should be interpreted as those of any activity undertaken to manage consciously the use of resources (Demsetz 1991, 1997).

Barzel (1989, p.2) defined a modest concept of transaction costs to include the costs of associated with the transfer, capture, and protection of property rights. In contrast, Cheung (1998) defined a comprehensive concept of transaction costs to include "all those costs that cannot be conceived to exist in a Robinson Crusoe economy, where neither property rights, nor transactions, nor any kind of economic organization can be found". These costs include the costs of information; of negotiation; of drawing up and enforcing contracts; of delineating and policing property rights; of monitoring performance; and of changing institutional arrangements. This broad definition is actually better to be called institutional costs, as Chueng himself said .

2.4.2 The Transaction Cost Paradigm

Williamson has committed to operationalize the concept of transaction costs into a refutable approach since the 1970s, and established transaction cost economics (Williamson 1975, 1979, 1985). He advanced that transactions are aligned in a discriminating way with governance structures, so as to effect economizing on transaction costs. This hypothesis is based on three assumptions on human behaviours, three dimensions of a transaction, and three dimensions of a governance structure.

1. Three Assumptions on Human Behaviours

Transaction cost economics assumed that the economic agents are characterized with bounded rationality, opportunism, and conscious foresight. The economic agents have no hyper-rationality. They are "intendedly" rational but only "limitedly" so (Simon 1961). They could seek their self-interests with guile, not reliably disclosing true conditions upon request or self-fulfilling all promises (Williamson 1985). They have some capacity to simulate the future in imagination to prevent from the worst consequences (Dawkins 1976). These behaviours are the human nature as we know it, and have profound implications for economic organization.

As a result of the above behavioural assumptions, any complex contract is unavoidably incomplete because of bounded rationality of the economic agents. It is too costly or simply impossible for the contracting parties to anticipate all future contingencies under conditions of high uncertainty in order to specify a complete state contingent contract. The combination of bounded rationality and opportunism means that any long-term incomplete contract will not be self-enforcing without credible commitments. For this reason, the *ex ante* safeguard arrangements should be made based on the conscious

foresight of the contracting parties. However, if transactions are associated with highly relationship-specific investments and under highly uncertain environment, the *ex ante* designed safeguard mechanism is still not enough, and the contract could be *ex post* maladaptive. Therefore, various *ex post* governance measures must be addressed for the transactions. Among these safeguard measures, internalization of transactions via vertical integration is an extreme mechanism for this purpose.

2. Three Dimensions of a Transaction

Transaction cost economics maintains that a transaction is the basic unit of analysis. A transaction occurs when a good or service is transferred across a technologically separable interface. There are three principal dimensions of a transaction: (1) the degree to which a transaction is supported by specific assets; (2) the uncertainty to which a transaction is subject; and (3) the frequency with which a transaction recurs.

Transaction-specific assets are the specialized investments undertaken to support a particular transaction. This kind of investments cannot be redeployed to alternative usage or by alternative users except at a loss of productive values. For this reason, asset specificity could result in an appropriable quasi-rent (Klein et al. 1978). The greater degree of asset specificity, the higher an appropriable quasi-rent is. Specific assets may take several forms, including physical, human, site-specific, dedicated assets, brand name capitals, and temporal specificity (Williamson 1991).

Specific assets could trigger interdependence and even bilateral monopoly between the contracting parties. The quasi-rent of one party's specific assets may be appropriated by another party through hold-up and other kinds of *ex post* opportunistic behaviours. Therefore, relationship-specific investments would never be made appropriately

without reasonable safeguard arrangements, which could affect economic performance. Economic organization (or governance structure) emerges as a means by which to economize on bounded rationality and to mitigate the hazards that accrue to human opportunism (Williamson 1999).

The combination of uncertainty and asset specificity has important implications for the transactional organization. If a transaction is non-specific, and little support of specific assets is needed, then, uncertainty has little influence on the organization of this transaction, because new trading relations can be easily arranged. However, when a transaction is specific, and transaction-specific investments are not trivial, uncertainty makes it imperative for the contracting parties to design safeguard apparatus. At the extreme situation, vertical integration is preferred.

The frequency of a transaction affects not only the unit cost from specific assets, but also the relationships between the trading parties. If a transaction is once for all, the trading parties will not value their relationships. If a transaction is frequent, the trading parties have to consider the consequences of any opportunistic behaviour.

3. Three Dimensions of a Governance Structure

According to Williamson (1979), a governance structure is an institutional matrix or framework, within which the integrity of a transaction is decided. The commonly recognized governance structures include market governance, hierarchy governance, and hybrid governance. There are three dimensions for an economic organization: incentive intensity, administrative control, and legal rule regime. The dimensions determine its adaptive capacities, cost advantages and competence.

In classical market, there are a large number of buyers and sellers. Traders bear no dependent relationship each other. Both contracting parties can turn elsewhere at little transition costs. And the relationships between the contracting parties are not valued to sustain. The contracting parties deal with opportunism based on their own experience as well as litigation, and adapt themselves to disturbances independently. The incentive intensity is highest, but the administrative control is lowest in classical market.

If a transaction needs little support from specific assets, and transaction costs are negligible, market governance could exploit static scale economy, realize collective pooling benefits, and avoid many bureaucratic hazards of internalisation. Market governance is preferred on both occasional and recurrent exchanges, which incurs the lowest production costs and governance costs. Williamson called it classical contracting (see Table 2.1).

When a transaction requires the support from specific assets to a nontrivial degree, the bilateral dependence between the two contracting parties occurs after the relationship-specific investments are made. The trading parties need to value their relationships in this circumstance, and also need to take measures to safeguard against opportunism and the *ex post* maladaptation. In those cases of occasional transactions associated with the significant specialized investments and formal contracts, the third party assistance is preferred. Williamson called this trilateral governance.

If the outcome of a transaction can be observed only by the contracting parties themselves *ex post*, and it is too costly to be specified *ex ante,* then, the third party involvement is not encouraged. This relational contract should be self-enforcing. That is to say, bilateral governance should be adopted. For self-enforcing contracting, the

value of relationships must be sufficiently high; otherwise, the high transaction costs resulting from safeguard and maladpatation could lead to internalization of the transaction.

Table 2.1 Matching Transactions with Governance Structures

		Investment characteristics		
		Non-specific	Mixed	Idiosyncratic
Frequency	Occasional	Market governance (classical contracting)	Trilateral governance (neoclassical contracting)	
	Recurrent		Bilateral governance / Unified governance (relational contracting)	

Source: Williamson 1979

As a transaction becomes very idiosyncratic, highly specific assets enhance the bilateral interdependence between the contracting parties. The maladaptation and safeguarding difficulties encourage internalization of the transaction, that is, unilateral governance, which is characterized with strong adaptation ability and high administrative control, but with low incentive intensity and high bureaucratic costs. Whether to adopt bilateral governance or unilateral governance depends on their comparative cost advantage.

In summary, transaction cost economics maintains that transaction costs are the central determinants of economic organization. The sources of transaction costs mainly come from the combination of bounded rationality, opportunism, specific assets, and

uncertainty. The asset specificity results in bilateral interdependence and appropriable quasi-rents. Due to opportunism, contracting parties may appropriate their trading partner's quasi-rents through opportunistic behaviours. Because of bounded rationality and opportunism, any long-term complex contract is incomplete and *ex post* maladaptive. Therefore, *ex post* governance must be addressed.

The choice of governance structure for certain transactions depends on comparative advantage of production and governance costs. Market governance is characterized with highly autonomous adaptative capacity, suitable for non-specific transactions. Various kinds of hybrid governances are needed to deal with adaptation and safeguard difficulties as asset specificity develops. Internalization or vertical integration is preferred when asset specificity rises to a very high degree for recurrent transactions. Vertical integration is convenient to control production and adapt to disturbances, but with highest bureaucratic costs and lowest incentives. Viable organization of transactions should be able to save both production and transaction costs.

2.4.3 Empirical Tests and Limitations

1. Empirical Tests

Since the 1970s, transaction cost economics has advanced spectacularly. A coherent set of concepts has been elaborated, and its empirical tests and applications have proliferated at a rarely observed rate in economics. Many researchers claimed that transaction cost economics is an empirically successful story (Menard 2001). Some researchers tested the theory in terms of econometric models, but majority of empirical tests adopted case studies.

Frank and Henderson (1992) examined the causal relationships between vertical

coordination and transaction costs in the U.S. food manufacturing industries. Firstly, they constructed a new vertical coordination index by incorporating input-output (I/O) data with other related statistical data. Secondly, they selected several proxies to transaction costs and structural characteristics as regressors. These regressors represent uncertainty, concentration, idiosyncratic investments, and internalization costs. The regression results of vertical coordination index on these proxies confirmed the significant relationships between vertical coordination and transaction costs, and supported the transaction cost hypothesis. The research pointed out that uncertainty, input supplier concentration, asset specificity, and scale economies are the most important driving forces of vertical coordination in the U.S. food industries.

Hobbs (1997) focused on an individual industry—the UK beef industry. She explored the underlying reasons behind the choice of marketing channels between liveweight and deadweight by UK cattle producers. A Tobit model was used to show the importance of transaction costs in channel choice decision.

Westgren (1994) used case study to examine why the coordination mechanisms of poultry industries differ among the Netherlands, France, Mexico, and the United States. He integrated the task environment into Williamson's transaction cost paradigm, and argued that the choice from the alternative governance structures is determined not only by the nature of transaction (e.g. asset specificity, programmability, non-separability, and risk), but also by the task environment of the firm (e.g. environmental dimensions, industrial organization, and government interventions), as well as the idiosyncratic characteristics of the upstream and downstream firms

Hobbs and Young (2000) proposed that product characteristics determine transaction

characteristics, which, in turn, influence transaction costs. The innovation of genetically modified organisms (GMOs) has differentiated from standard food products. They increased uncertainty and measurement difficulties, and therefore, increased transaction costs for these products. The marketing channel and industrial organization for these innovative products correspondingly changed, and typically moved toward closer vertical coordination.

2. Limitations

Although transaction cost economics has received strong empirical supports, this approach also has its flaws and weaknesses as any other innovative research programme. Firstly, the issues of definition and measurement of transaction costs have not been well resolved. That is why majority of empirical studies based on transaction cost approach adopted the case study. Secondly, transaction cost economics is based on the comparative static framework, and neglected the dynamic aspects, notably learning, innovations and strategy (Nooteboom 1992; Langlois and Robertson 1995; Hodgson 1998). Thirdly, it focused on exchange process while neglected production process (Boon 1999). Researchers from the competence perspective argues that the boundaries of the firm should be understood in terms of not only transaction costs but also learning, path dependence, technological opportunities, selection and complementary assets (Dosi 1994). Langlois and Robertson (1995) argued that one could not have a complete story about the boundaries of the firm without considering the process of learning in the firm and the market. The boundaries of the firm are determined by the relative capabilities of the firm against the market. Menard (2001) suggested that further exploration should address innovation and institutions. Which organizational mode is most favourable to develop the capabilities and to promote innovations? How

do the institutional rules diffuse into the governance structures and then contribute to the shaping of the economic organization?

2.5 The Principal-Agent Approach

The principal-agent approach is another branch of new institutional economics, which shares some common behavioural assumptions with the transaction cost approach, such as, bounded rationality and self-interests, but it differs from the transaction cost approach in assumptions on information symmetry and attitudes toward uncertainty. Transaction cost economics assumed symmetric information and risk neutral between the contracting parties, whereas the principal-agent approach assumes asymmetric information and relative risk aversion between the contracting parties. The transaction cost approach focused on specific assets, hold-up, ex post maladaptation, and alignment of a transaction with a governance structure. In contrast, the principal-agent approach focused on measurement difficulties, shirking, and alignment of incentive intensity with efficient risk sharing.

2.5.1 The Agency Issues

The agency problems occur when the principal engages the agent to perform some task on his behalf, which involves delegating some decision-making authority to the agent (Jensen and Meckling 1976). If the principal and the agent have different goals and different attitudes toward the risk, the agent will not always act in the best interests of the principal. In order to motivate the agent to perform as the principal would prefer, the principal needs to establish appropriate incentive mechanisms, to monitor the agent's activities, and to require the agent to pay bonds to guarantee that he will not

take actions harmful to the principal. In doing so, both the principal and the agent will incur the agency costs—the sum of monitoring expenditures by the principal; bonding expenditures by the agent; and residual loss of value that comes from a misalignment of the agent's incentives with those of the principal (Jensen and Meckling 1976). Therefore, the central task of the principal-agent approach is to find out an efficient governance structure to save the agency costs and to share the risk between the principal and the agent. Since the unit of analysis in agency theory is a contract, thus, agency researches focus on the most efficient contract that governs the principal-agent relationship, or specifically, on the choice between behaviour-oriented contract and outcome-oriented contract (Eisenhardt 1989).

The agency costs arise due to the frictions between the principal and the agent. Then, what causes the frictions? Sappington (1991) established a canonical setting where the agent may behave exactly as the principal would if the principal shared the agent's skills and knowledge. In this canonical setting, there are four special features: pre-contract information symmetry; risk neutrality; perfect commitment abilities; and publicly observable performance. If these four assumptions are relaxed, that is to say, if there exists precontract asymmetries of information, risk aversion, limited commitment abilities, or problems in measuring the agent's performance, the frictions occur between the principal and the agent.

If the agent has superior information than the principal before the contracting, the agent may take this opportunity to pursue his own interests. The possible opportunistic behaviours of the agent include pre-contract opportunism of adverse selection, and post-contract opportunism of moral hazards. On the other hand, if the agent is risk

averse or relatively more risk averse than the principal, the agent is not willing to bear all the risk, then the principal has to share the risk with the agent. However, sharing risk also means sharing returns. The agent is no longer the sole residual claimant. This will affect the agent's incentives or efforts. In other words, the agent has a different goal from that of the principal, and will not always act in the best interests of the principal. Consequently, the principal want to monitor the agent, to structure and update the arrangements, and to establish an appropriate incentive scheme. To do this, the principal needs to know what the agent is doing, what work has been done, how and by whom? Due to asymmetric information, task programmability and separability issues, it is difficult for the principal to verify what the agent is doing, to measure what the agent has done. As a result, the principal has to expend on information and measurement.

There are two kinds of contracts: outcome-oriented and behaviour-oriented contract. If an outcome-oriented contract is adopted, risk transferring may discourage the agent, and the principal faces measurement difficulties. If a behaviour-oriented contract is adopted, the principal has to solve monitoring issues; otherwise, the agent may shirk. The principal-agent approach has to deal with the trade-off between incentive intensity and efficient risk sharing. The agency theory argues that the agent is more likely to behave in the interests of the principal when the contract is outcome-oriented, or when the principal has information to verify the agent's behaviour. Thus, such factors as improved information system, higher outcome uncertainty, the agent's more risk aversion, more compatible goals, higher task programmability and measurability, and the length of the agency relationship, are positively related to behaviour-oriented contract and negatively related to outcome-oriented contract.

2.5.2 Limitations

The agency theory focused the *ex ante* governance mechanism design. However, Williamson (1990) argued that it is impossible to address and resolve all of the relevant contracting issues in advance, instead, much of the issues have to be dealt with during the contract execution period, and have to be resolved ex post by whatever governance structure. Mahoney (1992) argued that transaction cost economics provided the insight into the key role of asset specificity, but neglected interactive effects of measurement problems. On the other hand, agency theory emphasized measurement costs, but neglected asset specificity. Integration of these two perspectives may be fruitful. Mahoney suggested that governance structures are the function of three variables: asset specificity, task programmability and task separability.

Lajili (1995) tried to integrate the principal-agent approach with the transaction cost approach to construct a comprehensive framework. He argued that transaction attributes and individuals' characteristics jointly determine vertical coordination mode. The important determinants include asset specificity, risk attitudes, leverage position, and size etc. He tested and proved this hypothesis by the experimental approach.

2.6 The Competence-Based Approach

2.6.1 The Competence-Based Theory of the Firm

The transaction cost approach relaxed the perfect information assumption with the neoclassical framework, but it still insisted that the firms are homogenous as production units. However, this homogenous firm assumption was challenged by the competence-based approach. The competence-based approach argues that the firms are

heterogenous as production units because of imperfect knowledge and cognitive limitations, which lead to the differentiated competences or capabilities among the firms. Each firm must focus on its core competence that offers comparative advantage, and get the complementary competences from other firms. This division of competences among the firms is the essential sources of competitive advantage.

There are alternative ways for the firms to get their needed complementary competences, however, the costs with these alternatives are different. The purpose of choice of vertical coordination mechanisms is to save this kind of costs while still exploiting comparative advantage.

The competence-based theory of the firm can be traced back to Adam Smith and Marshall, although modern discussion of this theme began with Penrose (1959). The researchers developed the competence-based theory of the firm to explain the existence, boundaries, internal organization, and development of the firm (Richardson 1972; Teece 1980; Nelson and Winter 1982; Teece 1982; Wernerfelt 1984; Demsetz 1988a; Prahalad and Hamel 1990; Barney 1991; Kogut and Zander 1992; Langlois 1992; Nooteboom 1992; Teece et al. 1997).

The classical economists assumed that the economic agents are initially more or less homogenous, however, they are gradually differentiated as a result of division of labor. Marshall found that this process of differentiation and knowledge accumulation took place not only within an individual firm, but also at the level of industry and society. He referred them as internal economies and external economies, respectively.

Penrose (1959) further studied the internal economies from the endogenous growth of the firm. In her studies, the firm was viewed as a pool of resources that can be

accumulated over time. The firms became differentiated during this process of accumulation due to the imperfect knowledge and cognitive limitations. The embodied knowledge in physical capital and codified knowledge in blueprints are easy to transfer and communicate between the economic agents. However, the tacit knowledge is fundamentally empirical, largely idiosyncratic, and difficult to be expressed in verbal, articulated and unambiguous form. The firm accumulates knowledge essentially through collective learning, and further internalizes the knowledge as organizational routines. The organizational routines together with differentiated technological skills and complementary assets constitute the distinctive competences that provide the basis of the firm's competitive advantage in one or more businesses (Teece et al. 1994). As the firm accumulates knowledge in a specific historical context, the firm's competence is therefore path-dependent in nature. During this evolutionary process, technological opportunities and selection environment of the firm could significantly influence its critical competence and its boundaries.

Richardson (1972) studied the external economies from the organization of industry. He claimed that the economic activities in an industry can be classified into the similar activities and the complementary activities, the former requires the same capabilities for their undertaking, and the latter needs coordination along a production chain. The firm undertakes similar activities within its boundaries, while leaves dissimilar activities for other firms or market. There are numerous dissimilar or complementary activities in a supply chain. Any firm does not have necessary capabilities for all of the complementary activities. Therefore, a number of firms may exist along a supply chain; each of them needs to coordinate in some way.

There are three possible ways to coordinate: vertical integration, inter-firm cooperation and market transactions. For vertical integration, the firm needs to spread its current capabilities over more dissimilar activities or acquire the related complementary capabilities. This effort may be strongly limited by imperfect information and cognitive limitation of the firm. Spreading capabilities may result in higher production costs, higher governance costs and diminishing returns. Thus, the firm will not adopt internalization strategy unless there exist prohibitive transaction costs impeding contractual arrangements.

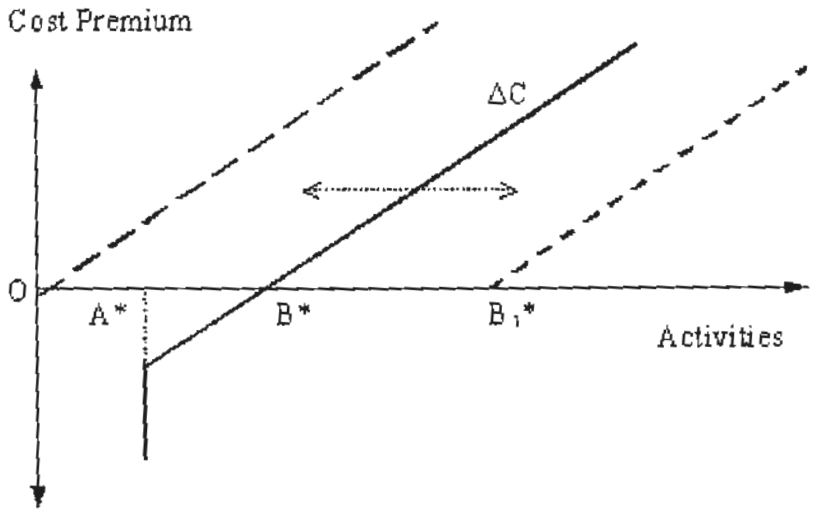
2.6.2 Learning and Vertical Coordination

The competence-based approach argues that the competences or capabilities with the firm are bounded, and it is costly and difficult for the firm to develop or acquisite new capabilities. All of the firms have to rely on the capabilities owned by other firms. Therefore, the firms must link up with each other in a chain of production. The boundaries of the firm are determined by the capabilities of the firm relative to the capabilities of the market (Langlois 1992).

However, both the firm and the market have the learning abilities. The learning abilities of the firm are determined by its internal organization and its absorptive capabilities, such as, the firm's existing related capabilities and R&D expenditure. The learning abilities of the market are determined by the institutional and technological factors as well as the learning abilities of other firms within the whole system. Over time, the firm may become more capable, and the market may become more capable either. Hence, the direction of changes in the boundaries of the firm depends on (at least in part) the relative strength of these two opposing forces (Langlois and Robertson 1995).

Transaction costs may change during the process of learning. Progressively improved contracts and reputation effects can reduce the possibilities of hold-up and other moral hazards during the repeated transactions. Actually, what matters in transactions is not real but perceived opportunism. The interactions of the contracting parties may change their perceptions. The building trust between the contracting parties may reduce transaction costs, less or no trust may lead to the collapse of the relations (De Jong and Nooteboom 2000).

Figure 2. 4 Firm Boundaries versus Relative Capabilities



Source: Adapted from Langlois and Robertson (1995)

The changing direction of the boundaries of the firm was demonstrated by Langlois and Robertson (1995, see Figure 2.4 above). The horizontal axis arranges the firm's activities in order of the increasing costs of internal production. The vertical axis stands for the normalized per-unit cost premium the firm must pay for the output of a particular activity if it internalizes that activity, measured relative to the per-unit cost it would incur by obtaining the output on contract from other firms. The negative cost

premium represents cost advantage to internal production, which suggests the firm could make these inputs by itself within the range of OB^*, particularly, the firm's intrinsic core capabilities dominate within the range OA^*. But the firm has disadvantage to conduct those activities beyond point B^*. The firm should buy those inputs through market transactions or through inter-firm cooperative arrangements.

In the long run, if the firm becomes more capable than the market, the line will shift right. The intersection point will moves from B* to B_1^*. This means that the firm will expand its scope and internalize more activities within its boundaries. On contrary, if the market becomes dominantly capable than the firm, the line will shift left. The intersection point B* moves toward left, to O at the extreme case. This means that the firm may shrink its scope, disintegrate, and become more specialized. This is the case predicted by the Stigler model. The Stigler model related specialization to the changes in the extent of market without assuming any changes within the firm. The competence-based approach, however, considered both external and internal changes in the firms, and related specialization to relative capabilities of the firm to the market.

2.6.3 Strategy and Vertical Coordination

Between the mid-1870s and the early 1970s, the firms were induced to internalize the intermediate markets in order to capture the economies of scale and scope arising from the technological, organizational and financial revolutions. Since the 1980s, modern firms tend to concentrate on their core competencies, and establish cross-border alliances in R&D to promote their core products in world market (Dunning 1998). However, this modern trend of disintegration also goes along with the impressive growth of merger and acquisitions. Researchers believed that strategy might influence

the industrial organization. The firms develop the strategies to take advantage of new opportunities; the strategies then determine the organizational structures for the implementation of the strategies (Chandler 1962).

Teece (1986) discussed the role of strategy in industrial organization by reference to an innovation firm. He argued that successful commercialization of an innovation depends to large extent on the access to the complementary assets, such as marketing, competitive manufacturing, and after-sale support. Not only systemic innovation needs coordination, autonomous innovation also requires certain complementary capabilities.

The ways that the firm obtains complementary assets will be determined by the nature of complementary assets, the appropriability regime of innovation, and position of the innovation firm in the market. Only if the complementary assets are specialized and critically important, the appropriability regime is weak, the imitators/competitors are better positioned, and the innovation firm's cash position is good, then the innovation firm may adopt the integration strategy; otherwise, the innovation firm can adopt market transactions or cooperative arrangements.

The firm strategy responds to the changes in institutional and business environment, which, in turn, is influenced by transaction costs. In order to implement new strategy successfully, the firm must take into consideration of transaction costs. The case study of Coca-Cola and Pepsi-Cola from the originally independent bottling system to the captive bottling system was claimed to support the hypothesis about strategy and organization (Muris et al. 1992). The closer cooperation from the bottlers was needed under the new business environment. However, this cooperation can be available only at significantly higher transaction costs by the independent bottlers than by the captive

bottlers. Hence, shifting distribution system from the independent bottlers to the captive bottlers can save transaction costs while implementing the firm's new strategy.

2.6.4 Limitations

Based on the evolutionary framework, the competence-based approach has provided distinct insights into economic organization by emphasizing the roles of imperfect knowledge in the division of labour, and by addressing the process of production instead of the process of exchange. Many researchers believed that it is complementary to the transaction cost approach, which addressed the process of exchange instead of production. But Williamson (1999) argued that there are many important processes, what are the priorities? He claimed that this approach is lack of operationalization, and some empirical studies had the problems of *ex post* rationalization.

2.7 The Framework of This Study

The above review demonstrates that there is a variety of determinants of vertical coordination. The neoclassical approach focused on market structure, the transaction cost approach focused on specific assets, while the competence-based approach focused on competences or capabilities. These determinants may individually or in combination influence boundaries of the firm. This study is based on the transaction cost approach to understand the changing vertical coordination in the Chinese agri-food system, which is characterized with increasing agricultural transformation, institutional transition, and trade liberalization.

During agricultural transformation, a traditional agriculture evolves into a relatively modern and commercialized agriculture; the operations originally integrated within

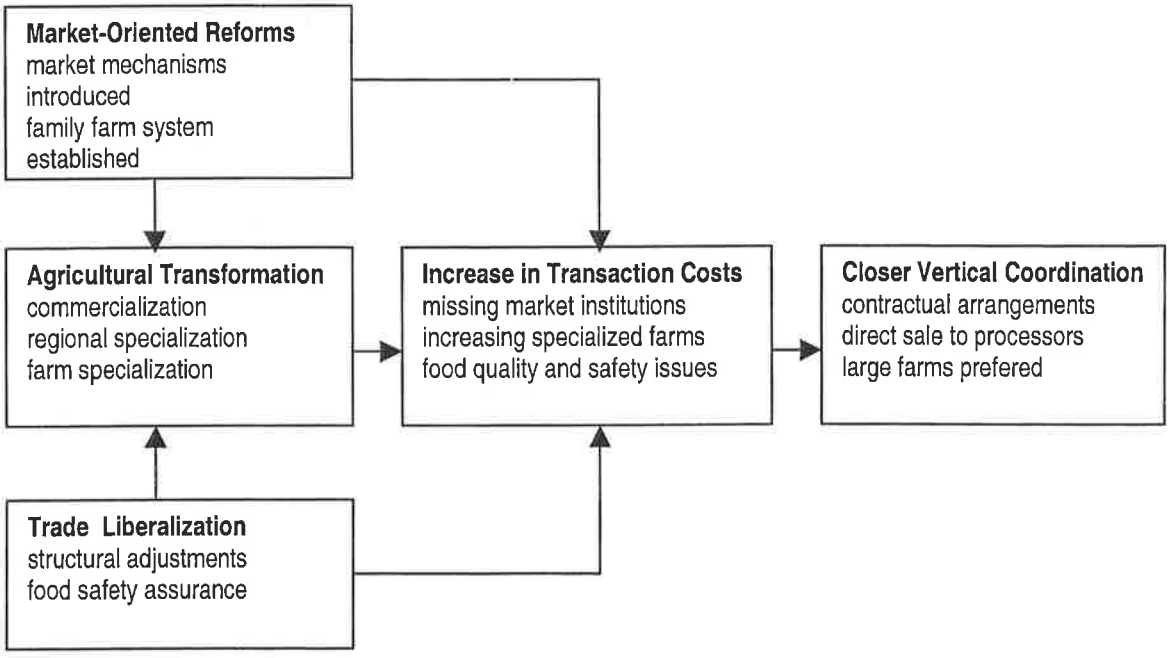
farms are disintegrated gradually into the related agribusinesses. At the meantime, interdependence between on-farm and off-farm operations becomes increasingly important (Davis and Goldberg 1957). The advances in agricultural commercialization and specialization require favourable market conditions. Transaction costs are important determinants of this process, in addition to the extent of market identified by Stigler. To a large extent, the process is determined by a trade-off between the economies of specialization and transaction costs (Yang and Ng 1993). The improved infrastructure and the advances in transaction technologies could raise transaction efficiencies, leading to lower transaction costs. Industrialization and urbanization can stimulate the integration of agriculture with the rest of national economy, which can save the transaction costs of agri-food products. All of these favourable conditions will further promote agricultural commercialization and specialization to realize the economies of scale and specialization in agri-food system.

Agricultural transformation in China has been seriously hindered by the centrally planned economy and the collective farming system. It was the market-oriented reforms that triggered the current process of agricultural commercialization and specialization. Two decades after the gradualist approach to market economy, China at last joined the World Trade Organization (WTO), and started to liberalize its food market to the world. Chinese agriculture has been increasingly integrated with the rest of national economy, and further integrated with the world food market. The increasing market integration made Chinese farmers increasingly dependent on markets.

However, the transaction costs are high due to missing marketing institutions and infrastructure, emerging specialized farms, and food quality and safety requirements.

Missing marketing institutions and infrastructure are the common phenomena in developing and transition economies. Emerging specialized farms are the results of agricultural transformation. And the issues of food quality and safety are highly related to trade liberalization. As a result, closer vertical coordination has emerged as one of the responses by private business to this dynamic institutional and business environment. The causal relationships are described in the analytical framework (see Figure 2.5). This study aims to find out the evidence for this transaction cost-based argument, and to discuss the policy implications for the transition and stakeholders. Next chapter introduces this framework in details by taking vegetable sector as an example.

Figure 2. 5 Dynamic Environment, Transaction Costs and Vertical Coordination



3. Driving Forces of Changing Vertical Coordination

3.1 Introduction

Increasing contractual arrangements in the Chinese agri-food system has emerged in the context of agricultural commercialization and specialization, which was triggered by the transition to market economy and further enhanced by trade liberalization. This context is significantly different from that in developed countries. As a result, potential implications for stakeholders and policy makers may be different either. This chapter focuses on the major driving forces of recently changing vertical coordination, with special reference to the vegetable sector—the most important export-oriented agri-food sector in China.

Next section introduces the dynamic institutional and business environment during the transition period. Section 3 explains why transaction costs in the agri-food system maintain at high level, and then relates transaction costs to changing vertical coordination. Section 4 briefly introduces vertical coordination in USA, Russia and OECD horticultural sectors for comparative purpose. The last section summarizes the chapter.

3.2 Dynamic Institutional and Business Environment

3.2.1 Institutional Transition

China has been in transition from the centrally planned economy to the market-oriented economy over the last two decades. The most important changes related to the organization of agri-food system include the establishment of family farm system and

introduction of market mechanism into the agricultural sector. More than 200 million rural households now become relatively decision-making entities or cells of exchange economy. And market mechanism has increasingly governed the operations of agri-food system.

1. The governing Institutions Before the Reforms

From the late 1950s, operations of agri-food system were fundamentally governed by three institutions: collective farming system; state monopolized procurement and distribution system; and food self-sufficiency policy (Lin 1997). These institutions contributed greatly to the rapid growth of heavy industries when the economy was still at its early stage. Under this institutional framework, farm products were supplied to urban residents and industries at very low prices through the administrative means in order to facilitate capital accumulation for industrialization.

However, the collective farming system was always afflicted with the principal-agent issues (Yang 1999). The monitoring costs were too costly, and actual supervision dropped to very low level, which led to the distortion of incentive structures and discouraging farmers to work hard. The state monopolized procurement and distribution system taxed the agriculture implicitly and sacrificed the farmers' interests. The food self-sufficiency policy saved scarce foreign exchanges for the economic development but hindered reasonable agricultural specialization based on the comparative advantage. These institutional arrangements under the command economy had ended up with a slow and unbalanced economic growth in a quarter century in China. The annual growth rate of grain production was 2.4 percent, only 0.4 percentage higher than the population growth rate during 1952-1979 (Lin 1988). The slow growth

of agriculture actually limited the speed of industrial development. The resource allocation in the economy was heavily distorted.

2. First Stage of the Reforms: Decollectivization

The poor performance of the economy at last triggered the rural reforms by the end of the 1970s. During the first stage of the reforms from 1978 to 1984, the household responsibility system (HRS) was introduced; the family farm system was established. More than 200 million rural households became independent decision-making entities. The family farm system avoided the difficulties in monitoring, supervision and measurement. The family farms become residual claimants of their own work. Such arrangements greatly stimulated the farmers' incentives to work. The agricultural output increased 7.7 percent annually from 1978 to 1984, 5.8 percentage higher than that from 1952 to 1978. The high growth of agricultural productivity during this period was mainly contributed by the introduction of HRS (Fan 1991; Lin 1992).

3. Second Stage of the Reforms: Market Liberalization

The second stage of the reforms started from the mid-1980s. Market mechanism was introduced into the agri-food system. The reforms adopted a gradualist approach in terms of both scope and degree. Market liberalization was carried out firstly in non-staple food sectors, such as horticultural and livestock sector, and then extended to staple food sectors, such as grain sector. The state monopolized distribution system was dismantled gradually by reducing food ration quota together with raising food ration price until the termination of food grain rationing system by 1992. The state monopolized procurement system was also relaxed by reducing government procurement quota together with raising government procurement quota price. In

contrast, market liberalization in non-staple food sectors, such as horticultural and livestock sectors, was complete, which provided the necessary institutional conditions for the fast agricultural commercialization and specialization in these sectors.

3.2.2 Agricultural Transformation

China is the largest developing country in the world. The high economic growth, stimulated by the institutional transition, has been maintained over the last two decades. The aggregate national economy has been expanded by five times, and foreign trade value expanded by 12 times during this period (Garnaut 1999, p.1). With the economic development, industrialization, urbanization and agricultural transformation have been accelerated. As major features of agricultural transformation, commercialization and specialization have advanced quickly; the agricultural sector has been increasingly integrated into the rest of national economy; and the linkage effects of the agricultural sector in the national economy have become more significant. China maybe has stepped into the third stage of agricultural transformation according to the definition by Timmer (1988).

1. Increasing Commercialization

In some economically advanced rural China, agricultural commercialization maybe occurred at least a century ago and had lasted almost for 50 years before being interrupted by wars (Brandt 1989). Since the early 1950s, agricultural commercialization had been hindered by the command economy. Actually, it was totally incompatible with three governing institutions described in the last section. The recent process of agricultural commercialization started since the market-oriented reforms in the 1980s.

The economic development and the outflow of surplus and resources from agricultural sector have speeded agricultural commercialization. In China, increasing withdrawal of rural labours from the agriculture and rural country has promoted this process. The demand for commercial food increases due to larger urban population, while the demand for subsistence food decreases due to less rural residents. The government has recently relaxed the restrictions on the migration from rural country to city. More than 350 million surplus rural labours are expected to migrate out of the agriculture. It will push further agricultural commercialization in the near future.

The income growth and then changes in consumption composition may also stimulate agricultural commercialization. The horticultural and livestock products have higher elasticities of demand in income. As incomes increase, the demand for these products will increase quicker than other foods. Because horticultural and livestock production have been completely commercialized, expansion of the horticultural and livestock sectors means the rise in general level of agricultural commercialization in China.

2. Regional and Farm Specialization

Specialization is a fundamental source of productivity growth. As a traditional agriculture evolves into a commercialized agriculture, the operations originally integrated within farms are disintegrated gradually into related agribusiness. The on-farm operations shrunk while off-farm operations expanded as Davis and Goldberg observed (1957).

The specialization at regional level is determined by the agronomic and climate conditions, also by the economies of scale in agri-food marketing (Timmer 1997). The forward and backward linkages of agricultural sector can be developed to efficient

levels only if the commodity is produced in a relatively cohesive spatial pattern. In China, certain degree of cohesive spatial pattern of agricultural production may be necessary for food processors to receive sufficient and stable supplies of raw agricultural products from numerous small farmers at reasonable transport costs, because the operational scale of the family farms is among the smallest in the world.

3. Fast Growing Food Processing Industries

As incomes per capita increase, the share of agriculture in a national economy declines, but off-farm agribusiness expands dramatically. That is why the share of agribusiness seldom declines to less than 20 percent even in the developed countries (Timmer 1988, p.292). The expansion of agri-food related input and output industries actually reflected agricultural transformation from another perspective.

Food processing industries are the most important agri-food related industries in China. They accounted for more than 10 percent of manufacturing industries in terms of value added, grew at the rate of more than 10 percent annually during the last two decades. Because they are labour-intensive in nature and with high employment multiplication effects, the growth of food processing industries can ease unemployment problems, create incomes and contribute to the social stability (Ross 2000).

The backward linkage effects of food processing industries can stimulate the demand for agricultural products, machinery products, chemical products and other tertiary industry services. Based on the Input-Output Table of China in 1992, it was found that that food processing industries absorbed about 27 percent of agricultural output if both direct and indirect usage is taken into consideration. Food processing industries are great and also fast growing markets for the agricultural sector as the economy grows

and agricultural transformation advances. As the percentage of off-farm business increases and the linkages between agriculture and food processing industries becomes closer, the organization of agri-food system may be altered.

3.2.3 Trade Liberalization

Integrating the agriculture into the world food market by eliminating the self-sufficient food policy is a logical extension of the transition after getting farmers and markets to work. (Huang 1998). Toward this direction, China has made a great progress by recently joining the WTO, but the effort has been committed much earlier. The rising ratio of agricultural trade to agricultural GDP from 10 percent in 1980 to 15 percent in 1997 proved that its agricultural market becomes increasingly open (Huang et al. 2000). The most important issues arising from trade liberalization include the international competitiveness and technical barriers to food trade. To deal with these issues, China has launched the agricultural restructuring program and food safety assurance program since the late 1990s.

The international competitiveness is basically determined by comparative advantage. China is rich in labor but lack of capital and land, labor-intensive industries may have potentials under free trade framework. Based on the principle of comparative advantage, labor-intensive agri-food industries have been promoted while land-intensive industries have been reduced. As the result of these structural adjustments, the horticultural and livestock sectors have increased dramatically during the last several years. The exports in horticultural and livestock products have also increased significantly.

Exporting labor-intensive agri-food products is a potential opportunity for the

developing countries to benefit from trade liberalization, but this opportunity has been challenged by the recently emerged food quality and safety issues, because fresh and processed food products are subject to greater food safety risks and potential trade barriers arsing from sanitary regulations (Unnevehr 2000). Consumers from importing countries demand higher standards on food quality and safety. Their governments modified legal regulations related to food safety, grades and standards, and genetically modified organisms, to emphasize not only the quality of final products, but also whole production process and production environment. As for horticultural and livestock products, pesticide residues, microbial contamination, parasites, food additives, heavy metals are the major safety hazards.

Japan claimed that pesticide residues in the spinach imported from China surpass the limitation standards by Japanese regulations, which immediately triggered serious market access barriers, and affected nearly all of the agri-food importing from China since the second half of 2002. The exports in vegetables, fruits, seafood, livestock, tea, and many other farm products from China are now confronted with similar challenges from the importing markets.

In response to the issues, the Chinese government upgraded food grades and standards, and established professional centres to test and monitor food quality and safety. The government has launched so-called "Actions for Non-Pollution Food", which aims to improve food quality and safety by controlling over the whole process of food production from farm to table since 2001. The agribusiness firms have also taken their own private actions, such as imposing strict quality inspection at the farmgates, adopting quality assurance systems, to signal the quality of their products.

3.3 Transaction Costs and Vertical Coordination

Both development economics and new institutional economics suggest that such dynamic institutional and business environment may have significant impacts on the organization of agri-food system. Realistic institutional framework and the nation's specific conditions determine that the operations of agri-food system must be based on the small family farm system. Increasing agricultural transformation means that the agricultural sector has been increasingly commercialized, specialized and integrated into the national economy and world food system. Recent accession to the WTO implies that the agriculture has to compete internationally. The sectoral adjustments within the agri-food system are based on the patterns of comparative advantage, while organizational restructure mainly aims to minimize transaction costs within the system. This section discusses why transaction costs in the agri-food system remain at high level, and why closer vertical coordination can save transaction costs.

3.3.1 Missing Market Institutions and Infrastructure

In transition economies, missing market institutions and infrastructure are common. Before the transition, the state farms or collective farms need not to concern about procurement of farm inputs or marketing farm outputs, because all of transactions were closely controlled by the administrative means, not by market mechanism. In that case, transaction costs in agri-food systems were low (but institutional costs were high). After the market-oriented reforms, farms and agribusiness firms became relatively independent entities. Transactions have to rest on market exchanges, no longer on the command. The efficient market operations then become critical determinants of the organization of agri-food systems. However, market efficiencies are seriously affected

by missing market institutions and infrastructure, which constituted the major sources of transaction costs in transition economies.

Missing market institutions and infrastructure may be even worse in China because it adopted a gradualist approach to market economy. In the agricultural sector, the price discovery mechanism has not well established yet; some commodity markets, such as grain market, are still regulated; some factor markets, such as farm credit and rural employment, are almost totally missing; farm service markets, such as market information and technological extension, are difficult to be established due to their public goods in nature; legal regulation and enforcement system is imperfect either. Too many small contracting parties made the enforcement costs too high, which in turn, induced even more contract breaching and holdup occurrences. Market risks and uncertainties in the agri-food system are very high.

According to Williamson (1979), high degree of market risks and uncertainties is necessary but not sufficient condition leading to high transaction costs. Another necessary condition is transaction-specific investments made by one trading party or by both parties. It is specific asset that creates the dependence or even bilateral monopoly between the trading parties. Specific assets are in variety of forms, including physical, human, site-specificity. In some agri-food industries, site-specificity is significant because the products are highly perishable and bulky; their transportation costs are high while shelf life is short. The performance of such agri-food industries highly depend on market operational efficiencies, thus, more sensitive to missing market institutions and infrastructure.

3.3.2 Increasing Specialized Farms

The market-oriented reforms and trade liberalization have promoted agricultural commercialization and specialization. Farmers' input and output decisions have increasingly based on the principle of profit maximization. Specialization at both regional and farm levels have emerged especially in horticultural and livestock industries. However, specialized farms may face higher market risks and uncertainties, and then depend on their first handlers or food processors, particularly when products are with significant site-specificity, such as vegetables. Specialized farms tend to have contractual arrangements with their first handlers or food processors. By doing so, they may avoid certain degree of market risks. But this can be achieved only at the expense of weaker bargaining power, considering the small scale of farms and dependence on their trading parties.

3.3.3 Food Quality and Safety Assurance

As the links between diet and health become more evident, modern consumers value increasingly on food quality, particularly nutrition and safety attributes. The food safety concerns have been intensified due to the recent outbreak of food borne diseases, and further complicated by the controversial release of genetically modified organisms (GMOs). As a result, the issues of identity preservation, labelling and traceability have been raised to ensure food quality and safety, and niche markets for organic or green food have also emerged as the richer consumers are willing to pay premium for higher quality food. On the other hand, the breakthrough of multilateral trade agreements on agriculture has led to lower trade barriers, higher trade volume and painful structural adjustments in both developed and developing countries. The interests groups lobby for

more technical barriers as means of protection of trade. The pressure from both consumers and interests groups has significant impacts on the regulations and legislations. And the regulations of grades and standards on food quality and safety have been used as so-called "green barriers".

In order to get access to foreign markets, food quality and safety assurance becomes a necessary condition. However, food quality and safety assurance typically incurs additional transaction costs arising from asymmetric information, moral hazards and monitoring (Unnevehr et al. 1999). Usually, food safety attributes are credence in nature; consumers have significant difficulties or cannot assess the attributes even after their consumption of the food. Such measurement difficulties and asymmetric information between sellers and buyers may lead to the failure of the market for food safety (Caswell and Mojduszka 1996), For ensuring food quality and safety, government interventions and quality signalling mechanisms are introduced, such as grades and standards regulations, informational labelling, third-party certification, and vertical integration. These public and private actions have important implications for the organization, productivity and competitiveness of agri-food industries.

Food quality and safety assurance could be more expensive in China because of the extremely small operational scale of the family farms, which averaged only half hectare of arable land per household. The quality and safety attributes of final products are determined over the food supply chains, including the first link of the chains: farm production. The extreme small scale of family farms leads to too costly testing fees or monitoring costs. Food processors have to pay much more on the controlling or monitoring farm production than ever before.

3.3.4 Vertical Coordination in China

As Menard (2000) stated that, inefficient governance structures will be eliminated if the economic agents obtain the freedom to choose from alternative coordination mechanisms. The institutional transition has provided such opportunities for the Chinese farmers. The institutional and organizational innovations have emerged firstly in the horticultural sector since the mid-1990s in Shandong province, the largest horticultural producing and exporting province in China. The model has been called *Nongye chanye hua* (means agroindustrialization in Chinese), which mainly refers to encouraging regional specialization and establishing channel captains to exploit external economies of scale in the condition of the small family farm system. Closer vertical coordination between farmers and channel captains are the core component of this model (Zhang 1997). There are currently more than 4000 channel captain food processors, coordinating 40 percent of farm households and 50 percent of arable land in this province (Wu 2002).

A task force has been set up to promote agroindustrialization nationwidely. It has been suggested as a national strategy for rural development by the 15th Central Committee Meeting of Chinese Communist Party. Since then, there have been increasing vertical coordination. According to the survey by MOA, there were 39 million rural households (15 percent of national total rural households) got involved in agroindustrialization in 1998 (Wan 2000). The coordination mechanisms include contractual arrangements (accounting for 80 percent), cooperative shareholdings (11 percent) and cooperatives (9 percent). Until 2000, 59 millions rural households have joined in agroindustrialization, accounting for 25 percent of the national total rural households (Du 2001).

3.4 Vertical Coordination: International Comparison

3.4.1 Vertical Coordination in USA

As early as in the 1950s, contract production and vertical integration has emerged in the U.S. broiler industry and several other agri-food industries. The US broiler production was still dominated by independent producers in the early 1950s. But this sector quickly shifted to contract production and vertical integration just in 5 years. The contract production and vertical integration accounted for 90 percent of broiler production in 1955 and further increased to 95 percent in 1960. Currently, this sector is almost totally covered by contract production and vertical integration. This organizational innovation in the U.S. broiler industry has been proved successful. It facilitated the adoption of new technologies, improved product quality control, assured farmers' market outlets, and provided steady supply for food processors. As a result, this sector has achieved high productivity and low costs, stimulating broiler consumption to increase almost 100 times during 1935-1997 in the United States (Martinez 1999). During the past several decades, the adoption of contractual arrangements and vertical integration has increased steadily in the US agri-food industries, although they are still popular only in a limited number of food sectors (Cramer et al. 2001, pp.28-29). Since the 1990s, dramatic changes in vertical coordination have occurred in the US pork industry. The contractual arrangements and integrated operations accounted for 40 percent of hog sales to packers in 1998. This percentage further increased to 59 percent in 1999 (Martinez 1999).

Vertical coordination in the U.S. broiler industry emerged in the context of agricultural commercialization, specialization and technological advances. Before the 1930s, nearly

all of US farms had a small flock of chickens for egg production. Chicken meat was only a by-product of these laying flocks. Most frying chickens were fowl, laying hens that had outlived their fertility. The profit opportunities for broiler production were turned into reality by dramatic increase in market demand during World War II. On the other hand, significant technological advances occurred in nutrition, medicine, building and equipment, and genetics during this period. The commercialization and specialization in broiler production encouraged the adoption of new technologies. However, efficient operational scales with these new technologies were quite large. As a result, substantial investments are needed in terms of both physical and human capital, which means dramatic increases in business risks. Since recognizing potential growth of broiler market and inducing demand for their feed products, large feed companies initiated contract production to reduce broiler growers' financial and income risks, and to encourage broiler growers produce more efficiently. The role of integrators was taken over by food manufactures since the 1970s (Martinez 1999).

The context of changing vertical coordination in the US pork industry in the 1990s was significantly different from that in the broiler industry early in the 1950s. The US agri-food industries have been highly commercialized, specialized, concentrated and consolidated. The highly capital intensive technologies are used in these industries. The concentration and consolidation in the US agri-food industries have been well documented (Sexton 2000; Cotterill 2001; Rogers 2001). The 100 largest food and tobacco processors accounted for about 75 percent of the value-added in 1997. The six largest supermarket chains controlled 52.6 percent of supermarket sales. The farm input industries also highly concentrated, especially farm chemicals, seeds, and genetics. The concentration and consolidation in pre- and post- farm sectors made farm sector a

weakest link in food supply chains. Concentration and consolidation have induced vertical coordination. The vertical coordination, in turn, facilitated further concentration.

3.4.2 Vertical Coordination in Russia

Before the transition, vertical relationships in Russia's agri-food systems were coordinated administratively similar to an integrated firm. The state farms and collective farms were the major forms of agricultural organization. Food processing was put under the umbrella of a single agency—APK (agro-industrial complex). The state procurement price and quota were formulated by the related central authorities, which coordinated production, processing and distribution along food supply chains.

Since the transition from 1991, farmland has been privatized, and market prices were liberalized. As a result, the former administrative linkages were broken. The state farms and collective farms could choose their own marketing channels, and agribusiness firms also became the independent entities. However, the privatisation target was not realized. The private family farms only accounted for 3 percent of agricultural output at their heyday in 1993, and then declined to 2 percent (Ioffe and Nefedova 2001). The former state farms and collective farms still dominated agricultural production. The livestock inventory they held was 70 percent of cattle, 65 percent of hogs, 60 percent of poultry (Yakunina et al. 1998). The large farms had few options to sell their products because of inadequate market infrastructure, lack of market information, poor transportation system. The large processors took advantage of this situation and became geographically monopolists. Some large farms also got similar market power in raw material supply. Monopoly or bilateral monopolies prevailed in Russian agri-food

systems during the transition.

The absence of market competition together with poorly enforced legal institutions caused the costs of using open market and price mechanism prohibitively high. Only a small part of farm products moved through open spot market. Fifty one percent of grains, 89 percent of livestock, and 97 percent of milk were sold through contracts and vertically integrated channels in 1995 (Yakunina et al. 1998). High transaction costs also resulted in poor performance of agri-food industries. Under this circumstance, new institutional arrangements emerged, which include: (1) farmers extended their activities into food processing by setting up their own processing facilities; (2) farmers established the community cooperatives within the regions to include the processors as their associate members; (3) both farmers and processors became the owners of their business each other through shareholding.

Although farmers' extending value-added chains into processing field may avoid such issues as payment delay and unfair profit distribution, this business strategy also brought about the issue of low capacity utilization. Some 25 percent of large farms established their own processing facilities, but two-thirds of these facilities were used less than 50 percent of their capacities in 1995. This strategy simultaneously caused the capacity utilization of the established processors to drop to 30-40 percent in 1997 (Yakunina et al. 1998). The food processing output declined 50 percent during 1991-1998 (Ioffe and Nefedova 2001).

In this context, the government initiated a program whereby processors were required to provide newly issued or redistributed stock shares to producers. So the producers can receive dividends in terms of property rights of processing facilities. On the other side,

the processors were also encouraged to buy shares from producer stock companies. However, this strategy was not attractive either, due to the low profitability of agribusiness.

3.5 Summary

The major driving forces behind the recently changing vertical coordination in the Chinese agri-food system include the institutional transition, agricultural transformation and trade liberalization. Market mechanism was introduced into the agricultural sector by the market-oriented reforms. The economic development promoted agricultural transformation. Increasing commercialization and specialization in the agricultural sector have made market transactions more important. However, missing market institutions and infrastructure prevailed in the developing and transition economies. Farmers were confronted with seriously transactional difficulties. This situation was exacerbated by recently emerged food quality and safety issues. As a result, transaction costs in the Chinese agri-food system are very high.

The missing market institutions and infrastructure are particularly serious in developing and transition countries. During the institutional transition, the central plan system collapsed, while new market mechanism has not been well established yet. The missing linkages prevail in agri-food system and the issues become even more complicated when small farmers dominate the agri-food industries. Contract farming may help small farmers, but in many occasions, integrators still prefer large scale farms.

The food quality and safety issues have profound implications for the organization food supply chains. Agribusiness firms adopt private branding or quality assurance system to

attract consumers and to keep market shares. They restructure their production process from the supply of raw materials to the retail services. Food supply chain management has been extensively adopted by multinational agribusiness firms, especially by foreign direct investments.

These driving forces are significantly different from the advanced market economies, such as the United States, where agricultural transformation has been finished; the agricultural sectors have been highly industrialized and concentrated; and the monopolies in agri-food systems are significant. The market concentration and monopoly is an important source of market imperfections in these countries. In China, however, agricultural transformation has not been finished yet; small households dominate the agricultural sector. The missing market institutions and infrastructure are major sources of market imperfections.

Compared with Russia, both countries are commonly characterized with missing market institutions and infrastructure. However, the two countries are at different stages of economic development. Their operational scales of farms are also greatly different. In Russia, monopolies between trading parties are significant issues because both state farms and agribusinesses have been highly concentrated and consolidated, which constitute major sources of transaction costs. In China, food processors have not been highly concentrated yet. The small operational scale of farms and small farmers' access to markets are major sources of transaction costs.

Next two chapters empirically study the major determinants of changing vertical coordination in the vegetable sector based on the transaction cost approach. Chapter 4 tries to find major determinants of marketing channel choice by vegetable growers in

terms of Logit models. Chapter 5 analyzes food processors' decisions in their procurement channel choices under the situation of emerging food quality and safety issues.

4. VEGETABLE MARKETING CHANNEL CHOICE—LOGIT ANALYSIS

4.1 Introduction

This chapter studies the determinants of recently changing vertical coordination in the Chinese agri-food system through analyzing marketing channel choice by vegetable growers. The vegetable industry is the most important export-oriented agri-food industry in China, and increasing contractual arrangements have emerged in this industry since the mid-1990s. Vegetable marketing channels have been experienced significantly shifts from middlemen and wholesale market to direct sale to food processors. Our empirical study aims to approve that this kind of shifts were mainly determined by transaction costs arising from the institutional transition, agricultural transformation and trade liberalization.

Marketing arrangements are different from coordination mechanisms, because the same channel may be arranged in terms of different coordination mechanisms. However, previous studies have shown that different marketing channels may impose different types and/or levels of transaction costs on the participants of channels. The changing institutional and business environment may affect the channels in different ways and to different extent. Therefore, marketing channel choices may reflect the changes in transaction costs (Hobbs 1996; Boger 2001).

Section 2 introduces the background of vegetable industry in China. Section 3 describes the household survey in Laiyang City, Shandong Province. Section 4 analyses the determinants of vegetable marketing channel choice in terms of Logit regression models. Section 5 summarizes this chapter.

4.2 Growing Vegetable Industry in China

Vegetables are characterized with relatively high elasticity of demand in income, and the growing domestic demand for vegetables has been stimulated by high economic and income growth in the last two decades. On the other hand, vegetables are also characterized with relatively high labor-intensity, therefore, the vegetable industry may hold comparative advantage because China is rich in labor but lack of arable land or capital. Based on the belief that labor-intensive industries may be competitive under free trade framework, the government has taken measures to encourage the growth of vegetable industry. Within a relatively short period, the vegetable industry has been developed into one of the most important export-oriented agri-food industries in China, and also one of the largest vegetable industries in the world. In 2000, vegetable production valued RMB 280 billion, the second largest planting industry, just next to grain industry (RMB 460 billion). Vegetable transactions valued RMB 300 billion, even 50 percent higher than grains (RMB 200 billion) due to higher commercial rate than grains. Vegetable exports valued US$ 2 billions, the largest export item within agri-food products. The vegetable industry in China accounts for about 30 percent of world's total vegetable planting area and about 40 percent of world's total vegetable production according to Farmer's Daily (January 31, 2002).

Before the market-oriented reforms, vegetable industry was only a minor one in the Chinese agri-food system. Vegetables were mainly produced by suburban collective farms. Rural residents produced vegetables only for their own consumption. The institutional reforms have stimulated the economic and income growth. Then, market demand for vegetables and other high-value food products has increased dramatically,

which could not be satisfied by existing production capacity. Under such circumstance, the government launched so-called "Vegetable Basket Project" in 1988, which aims to increase production of major non-staple foods, including vegetables, meat, milk, eggs and aquatic products. Under this project, vegetable and other non-staple food production bases were expanded significantly, from suburban to some agronomic favourable rural area; new production technologies were introduced, such as greenhouse prodcution and high yield varieties; infrastructure promotion and modern farm inputs were subsidized by the government at different levels; nation wide network of wholesale market system was preliminarily established to facilitate interregional transactions of vegetables and other non-staple foods; horticultural and livestock producers were permitted to make their own production decisions based on market conditions. This project has raised the importance of the vegetable industry in the agri-food system. The dramastic growth of the vegetable industry not only satisfied domestic demand, but also raised farmers' incomes.

Since trade liberalization, the vegetable industry has been further promoted based on the fact that vegetable industry is a labor-intensive industry and that China has too much surplus rural labors but lack of arable land. At current stage, exporting vegetables and fruits only accounted for less than one percent of total production in China, however, the absolute values of exports and the shares in major importing markets increased significantly (Shields and Tuan 2001; Huang 2002). The major importing markets include Japan, Hong Kong, South Korea, Netherlands, USA, Singapore, and Russia. Aomong of them, Japan is the largest importing market, which absorbed 50 percent of China's total exports of fresh vegetables and 55 percent of China's total exports of processed horticultural products during 1998-2000. About 50 percent of

Japan's total imports of processed vegetables and fruits were from China in 2000 (Huang 2002).

As the vegetable industry has been turned into more export-oriented one, food processors play an increasingly important role in vegetable supply chains, particularly, in global vegetable supply chains. Food processors usually purchase fresh vegetables through middlemen or wholesale markets, and vegetable growers also take advantage of these market channels to save marketing costs. However, situation has been changed since the emergence of food quality and safety issues, typically pesticide residues for vegetables. Majority of farmers and processors have shifted their marketing channels from middlemen and wholesale market to direct sale to food processors, because transaction costs with traditional marketing channels became too high, or food quality and safety control along vegetable supply chains became too difficult.

Figure 3.1 Marketing Channels between Farmers and Processors

4.3 Household Survey on Vegetable Growers

4.3.1 Descriptions of Survey Variables

Marketing vegetables are costly due to the characteristics of perishibility and bulkiness. An early study estimated that marketing costs accounted for about 70 to 80 percent of retail prices in the United States at the early of 20th century (Adams 1968, p.40). A more recent study by Industry Commission (1992, cited in Jansen 1994) estimated that transportation costs alone may account for up to 60 percent of horticultural products' retail prices in developing Asian countries. A World Bank report estimated that wholesale-retail market margins for six important vegetables in China were from 23 percent to 69 percent (World Bank 1996), and the synthetic price margins from farmgate to consumer by the report was even as high as 72 percent (see Appendix C).

Because of perishibility and bulkiness, vegetable production is characterized with significant site-specificity for both farmers and food processors. Small vegetable growers largely depend on first handlers or local food processors to provide stable outlets for their easily perishable products. Similarly, food processors also depend to some extent on local vegetable growers to supply cheaper and fresh vegetables. Technological advance in information, communication and transportation may relax such constraints or bilateral dependence, but the effects of technological advance on vegetable marketing in developing and transition countries are still limited.

In transition countries, major sources of transaction costs come from missing market institutions and infrastructure. In developing countries, increasing agricultural commercialization and specialization may raise the level of transaction costs. For example, specialized vegetable growers may face higher market risks and

uncertainties than diversified farms. These specialized farms may become more dependent on their first handlers or local food processors. In both developing and transition countries, food quality and safety issues may have more important implications for their agri-food systems, because exporting fresh and processed food represents their major opportunity to benefit from trade liberalization, but subject to greater food quality and safety risks and potential trade barriers.

For ensuring food quality and safety, the whole process of food supply chains has to be controlled. However, market transactions across successive stages of food supply chains have to incur extra transaction costs due to costly testing fees, asymmetric information between trading parties, and potentially opportunistic behaviours of trading parties. Shifts in marketing channels between vegetable growers and food processors from middlemen and wholesale market to direct sale to food processors may save transaction costs while ensuring food quality and safety.

In order to test the above transaction cost-based arguments for shift in vegetable marketing channels, hosuehold survey has been conducted on vegetable growers with structured questionnaire. The variables and their measurement in the questionnaires are lised in Appendix A on page 158. We explain further how these variables are related to transaction costs. Transaction costs are difficult to measure directly, therefore, our variables only represent contributing factors to transaction costs. In this study, the dependent variable is *marketing channels*, which is a nominal variable with 2 values: 0 represents farmers' selling their vegetables via middlemen or via wholesale market; 1 represents farmers' selling directly to the food processors. The first choice can be seen as market channel, whereby transactions are basically directed by price signals. The

channel of direct sale to the food processor, however, is more tight than first channel. By this channel, food processors may assume some degree of control over vegetable growers, which is especially useful when food quality and safety assurance becomes a critical factor of their competitive advantage. The quality control and process management are too costly or even impossible if food processors choose first two channels. Thus, the direct sale to the food processor can be treated as a transaction costs-saving option.

The dependent variable is supplemented by another variable—*contract type*, usually reflecting the choice of governance structures. Transactions between farmers and their first dealers can be realized through open spot markets, contractual arrangements, or vertical integration. Vertical integration is not popular in China (and not popular in the developed countries either). Only open spot market and contractual arrangements have been found in this sample. Therefore, *contract type* just indicates whether a transaction is arranged in terms of contract or not.

The explanatory variables in this study may be divided into four groups. The first group includes *farm specialization*, *specific investments*, and *food quality inspection*. This group of variables reflect small farmers' dependence on their trading partners during agricultural specialization and trade liberalization. The more dependent, the higher transaction costs. In other words, small vegetable growers are forced to choose closer vertical coordination (the direct sale to the food processors). While classical transaction cost approach most emphasizes specific investments and regard it as major source of transaction costs, this study assumes that except for transaction-specific investments, farm specialization and food quality inspection may also contribute to the farmers'

dependence on their trading parties. Here, *specific investments* is narrowly defined specific investments made by farmers for their vegetable transactions, which is a 5-grade ordinal variable. *Farm specialization* is measured in terms of percentage of household incomes from vegetable production. *Food quality inspection* refers to testing pesticide residue in vegetables, which is a binary nominal variable.

The second group contains *farm service*, *price fluctuation* and *information access*, which reveals farmers' motivations behind their adoption of closer vertical coordination. In contrary, the situation of lack of farm service, serious price fluctuation, and difficult to access to market information represent higher transaction costs. Closer vertical coordination may avoid some of transaction costs. *Farm service* is a 5-grade ordinal variable, which refers to farm input provision, quality control and marketing service. *Received price fluctuation* is a 3-grade ordinal variable, reflecting historical changes in transactional prices between farmers and their buyers. Small farmers choose vertical coordination in order to avoid market risks. *Market information access* is a 5-grade ordinal variable, indicating how difficult for small farmers to get to know market information.

The third group, consisting of farmers' *bargaining power* and buyers' *payment delay*, reflects potential consequences for small farmers if they choose closer vertical coordination. Transaction cost approach suggests that the more specific investments made by one trading party, the more likely this party would face hold-up by the other party. Therefore, *ex ante* safeguard measures and *ex post* governance structures are necessary to deal with hold-up. In this study, it means that the more dependent on their first handlers or food processors, the weaker bargaining power and more likely

payment delay by the trading parties. *Bargaining power* is a 5-grade ordinal variable, which refers to whether farmers passively accept transaction prices or negotiate against their buyers. *Payment delay* is measured in terms of months the buyers delayed their payments to vegetable growers.

The last group measures the possible role of *operational scale* and *transport costs* in marketing channel choice. The operational scale here is measured by multiplying cultivation area with cropping intensity. Transport costs may also influence farmers' marketing channel choice, because if vegetable growers decide to buy their own transport facilities, then, they have to make more specific investments for their vegetable transactions.

4.3.2 Sampling of the Survey

The household survey was conducted in Laiyang City of Shandong Province. The location of this City see Figure 4.1. Shandong Province is the largest vegetable producing and exporting region in China. In 2000, Shandong Province exported 742 thousand tons of vegetables, accounting for 23.6 percent of national total export volume. Its export values from vegetables were US$ 440 millions, accounting for 21.6 percent of national total export value. Laiyang City lies in the middle of Shandong Peninsula. The City has an area of 1734 square kilometers, consisting of 14 towns and 784 villages, with a population of 0.89 millions. In 2000, Laiyang City exported foods of US$ 143 millions, majority of which were vegetables and fruits.

The sampling technique used in this study is not a purely random sampling methodology but a typical sampling methodology. The research object in this study is the vegetable industry in Laiyang City of Shandong Province. Shandong Province is the

largest vegetable producing and exporting region, where closer vertical coordination has emerged since the mid-1990s, especially in vegetable industry. The experience of improved vertical organization in vegetable industry in this region has been promoted to the rest of the country.

Figure 4. 1 Location of Laiyang City in the Map of China

In order to limit the survey scope, Laiyang City of Shandong Province was selected because this city is a typical city in producing and exporting vegetables in Shandong Province. Within Laiyang City, We further narrowed the scope to three villages where vegetable industry dominates their agricultural production. The survey sample composed of 90 vegetable growers from three villages in Laiyang City: Zhaowan, Longwan, and Muyu Dian. The sample targeted at three different types of marketing channels from vegetable growers to their first handlers: middlemen, wholesale market, or direct sale to food processors. For each type, 30 households were selected randomly from the above three villages.

The first type is that small farmers sell their vegetables to middlemen, then middlemen shipper to wholesale markets or food processors. Usually, there is no contractual arrangements between vegetable growers and middlemen by this channel. The changes in market conditions are completely reflected in transaction prices, which vary greatly between seasons and between years.

The second type is that vegetable growers themselves ship their products directly to wholesale markets. By doing so, vegetable growers save the commission fees to middlemen, and they could better know market information and gain some bargaining power in their transactions. But vegetable growers have to spend money on transporting vegetables from farmgates to wholesale markets, then wait a long time for potential trading partners in wholesale markets.

Third type is direct sale to food processors. The large scale vegetable growers usually produce organic food or "green food"—pollution-free food. The close linkage between large scale vegetable growers and food processors save transaction costs and ensure food quality and safety. Under the circumstance of increasing concerns about food quality and safety from both domestic and foreign consumers, food processors were motivated to adopt this arrangements to signal their product quality and then gain competitive advantage.

Although there were three marketing channels identified above, we combined the first two channels into one channel, that is, we put middlemen and wholesale market together as spot market channel. In contrast, the direct sale to food processors was treated as another channel. Such treatment was based on the following reasons: firstly, our survey sample was relatively small, fewer varaibles were desirable for model

construction; secondly, our research aims to investigate the determinants of closer vertical coordination, both middlemen and wholesale market are less controled by trading parties, therefore, they are spot market-like. On the other hand, the direct sale to food processors is more controled by food processors. It is a form of relatively closer vertical coordination. Distinction between these two types of marketing channels may help to find the determinants of closer vertical coordination.

4.3.3 Summary of the Survey

The household survey is summarized in Table 4.1, from which the relationships between marketing channels and independent variables can be briefly identified. In the first group of explanatory variables, farm specialization is clearly correlated to direct marketing and contractual arrangements. Those farmers who sell their vegetables directly to food processors usually adopt contractual arrangements, and are almost totally specialized in vegetable production. They earned 97 percent of their household incomes from vegetable production on average. In contrast, the less specialized farmers usually sell their vegetables to the middlemen. They earned only 58 percent of their household incomes from vegetable production. The specific investment made by farmers was quite little yet. However, farm specialization can be perceived as a kind of specific investment, because it could lead farmers to depend on their trading parties. The ratio of pesticide residue test against without test was low for the channels of middlemen and wholesale market, in contrast, the ratio was very high for the channel of direct sale to food processors. As less food processors accept the supply from middlemen or wholesale market due to difficult traceability, the direct marketing to food processors may become only feasible channel to test pesticide residue in future.

In the second group, it is apparent that the farmers sell their products directly to food processors could receive more farm services (moderate) and more stable prices (10%-30%), but their access to market information have not been much improved, because wholesale markets can provide farmers with easier access to market information. Under the condition of highly volatile horticultural markets and imperfect market institutions and infrastructure, even a moderate farm service and moderate price changes are attractive incentives to small farmers.

Table 4. 1 The Summary of Household Survey

Marketing Channels	Spot Market Channel	Direct Market Channel
No. of households	60	30
Contract type	0	1
Farm specialization (%)	69	96.7
Specific investment (5 grades)	1.02	1.57
Quality inspection (ratio)	0.48	0.97
Farm service (5 grades)	1.07	2.77
Price fluctuation (3 grades)	2.77	2
Information access (5 grades)	3.85	3.7
Bargaining power (5 grades)	4.17	1.1
Payment delay (months)	2.08	1.7
Cultivation area (mu)	3.92	69.4
Transport costs (¥/mu)	152	75

In the third group, hold-up is a significant issue with direct marketing to food processors. Farmers who sell their products directly to food processors can only accept passively the prices set by the processors. As for payment delay, farmers receive cash

payment immediately if they sell their products via the wholesale market. But they have to wait for 4 months on average if they sell their vegetables via the middlemen, and wait for 2 months if they sell directly to processors.

In the fourth group, farm size is quite different among three marketing channels. The average farm size under direct marketing channel is 69.4 mu (15 mu = 1 hectare), while the average sizes under the middlemen and wholesale market channels are only 3.92. The average farm size under direct marketing channel is 16 times larger than those under other channels. As for transport costs, those farmers who sell vegetables to the middlemen incurred little transport costs because middlemen buy vegetables at farmgates. However, if they sell their vegetables via wholesale market, they have to incur quite lots of transport costs. The figure of transport costs in this sample only considered the direct transport costs incurred by vegetable growers in selling vegetables to their first handlers. The figure did not include those transport costs beyound the first hanlers. Actually, transport costs beyound first buyers may be much higher. This can be seen from an example of vegetable price margin from farmers to consumers constructed in a World Bank report (see Appendix C on page 160).

4.4 Logit Analysis of Marketing Channel Choice

The purpose of our study is to explain why increasing farmers choose closer vertical coordination instead of open spot market in the vegetable industry. The survey revealed that farmers have three alternative marketing channels to sell their vegetables: via the middlemen, via the wholesale market, or directly sell to the processors. The first two channels could be combined as the market channel, because it is the market price that coordinates vegetable marketing in these two channels. In contrast, the administration

plays more important role in transactions if farmers sell their vegetables directly to food processors. That is to say, vertical coordination mechanisms are different between spot market channel and direct market channel. In this sense, marketing channel decision by farmers could be taken as a binary choice between spot market channel and direct market channel to food processors. Therefore, binary Logit models can be used to analyse the determinants of farmers' marketing channel choice.

4.4.1 Single Variable Analysis

There are many factors that influence marketing channel decision by farmers, but this study only deals with those factors concerned with the transaction cost approach. Firstly, we have conducted a series of single variable regressions in terms of Logit models to explore the significance of the survey variables in the vegetable marketing channel choice by farmers. The regression results of these single variable Logit models are reported in Table 4.2.

The second column of Table 4.2 is likelihood ratio test statistic (χ^2) for each single variable Logit model. We know that at the 0.01 significance level, critical value of $\chi^2(1)$ is 6.6439. The hypothesis that all slope coefficients are zero can be rejected at the 0.01 significance level for seven Logit models, including farm specialization, specific investment, food quality inspection, farm service, received price fluctuation, farmers' bargaining power, and vegetable planting area. However, null hypothesis cannot be rejected for the rest of three Logit models. They are market information, payment delay, and transport costs.

The individual variable coefficients can be checked in terms of t test. From the last column of Table 4.2, we can see that six variables are significant at the level of 0.01.

Market information, payment delay, and planting area and transport cost are not significant. The signs of the coefficients of farm specialization, specific investment, quality inspection, and farm service are positive, which indicate that these variables positively contribute to the choice of direct marketing channel. The signs of the coefficient of received price fluctuation and bargaining power are negative, which means that if farmers choose direct marketing channel, they may have less price fluctuation, however, they may have less bargaining power in their transactions with food processors either.

Table 4. 2 Regression Results of Single Variable Models

Variables	β	S.e.	t	χ^2	Sig.
Farm specialization	.087	.022	3.955	33.96	.000
Specific investments	3.718	1.073	3.465	29.92	.001
Quality inspection	3.434	1.049	3.274	25.27	.001
Farm services	2.829	.638	4.434	61.90	.000
Price fluctuation	-1.682	.395	-4.258	23.91	.000
Information access	-.152	.224	-.679	.456	.499
Bargaining power	-2.419	.573	-4.222	84.01	.000
Payment delay	-.039	.073	-.534	.292	.595
Planting area	4.325	29.414	0.147	102.21	.883
Transport costs	-.004	.002	-2.000	5.70	.027

Based on χ^2 test and t test, we found six variables significant in explaining variation of marketing channel choice by farmers. Then, marginal effect analysis has been conducted for these six significant variables. The results are reported in Table 4.3 below. The marginal effects of all coefficients are significant except farmers' bargaining power.

Table 4. 3 Marginal Effects of Single Variable Models

Variables	Coefficient	t	Significance
Farm specialization	.0132	5.719	.000
Specific investments	.8597	2.979	.003
Quality inspection	.6040	5.112	.000
Farm services	.6637	3.531	.000
Price fluctuation	-.359	-4.089	.000
Bargaining power	-.1101	-1.356	.175

The following sections will discuss those significant variables. Here the reason why market information, payment delay, and planting area are not significant in the single variable regressions is explained. The contract farming theory argues that contractual arrangements could make it easier for small farmers to know market information (Key and Runsten 1999). This thesis survey demonstrates that wholesale market is a better option for farmers to get access to market information. According to the survey, farmers' ability of access to market information is different among three alternative

marketing channels. Based on the 5-grade ranking, the marketing channel via middlemen grades 3, the marketing channel via wholesale market grades 5, whereas the direct marketing channel grades 4. If marketing channels via middlemen and via wholesale market aggregated into spot market channel, the average grade is four, which is not different from that of direct market channel. Consequently, binary Logit model cannot discriminate between spot market channel and direct market channel in terms of farmers' access to market information.

Table 4. 4 Marginal Effects of Information Access Variable

	Middlemen	Wholesale Market	Food Processor
Coefficient	-.2452	.3050	-.0599
Standard error	.1015	.1459	.0624
t statistic	-2.416	2.090	-.959
Significance	.0157	.0366	.3374

Even without data aggregation, access to market information is not a significant contributor to direct market channel either. This can be shown by the multinominal Logit model, which regresses market information on dependent variable with three marketing channels. The regression results shown that information access has negatively affected farmers to adopt the marketing channel via the middlemen, positively attracted farmers to adopt the marketing channel via the wholesale market, but had no significant impact on direct market channel choice. The t statistic for the

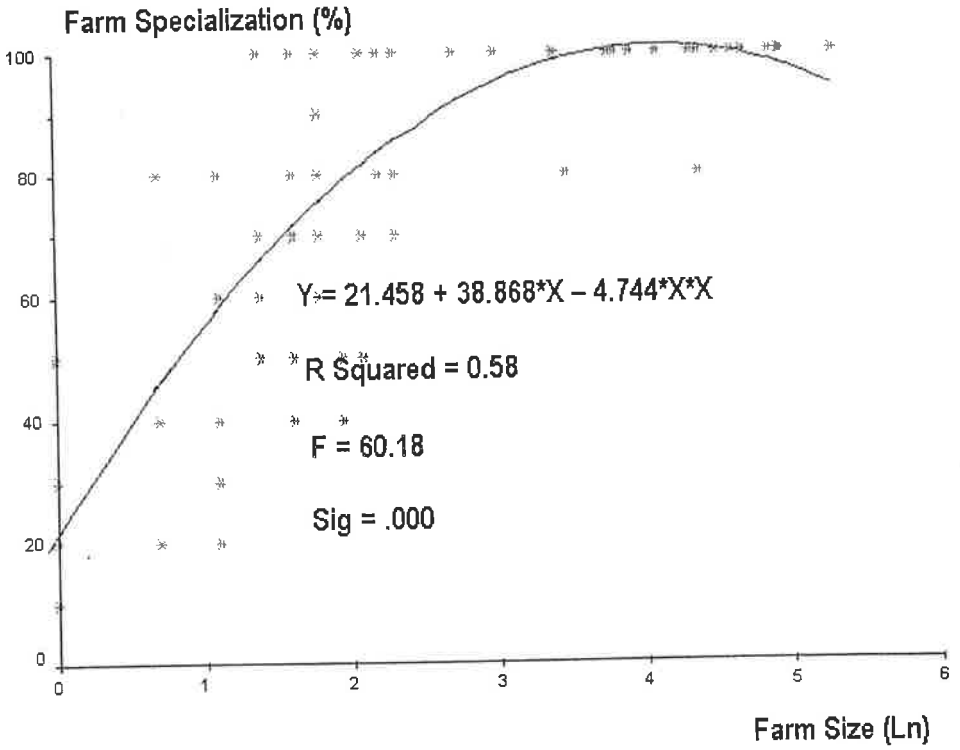
coefficient of direct marketing channel is only -0.959, the significance level is 0.3374 (see Table 4.4). This may reflect the fact that contractual prices are totally determined by food processors.

Payment delay is a kind of hold-up. The transaction cost approach argues that the more specific investments made by a trading party, the more likely another trading party would take advantage of it. This survey revealed that, on average, payment delay by middlemen is 4 months; payment delay by food processors is 2 months, while payment delay by wholesalers is almost zero. When the payment delay by middlemen and by wholesalers are aggregated into the payment delay in spot market channel, the average payment delay in spot market channel is 2 months, which is not different from that in direct market channel. That is why the payment delay is not significant in binary Logit model analysis. Unlike information access, the regression of payment delay by using multinominal Logit model cannot be properly conducted due to data limitations.

As for cultivation area, regression results contradicted our perception that larger farmers are more likely to choose direct market channel. The survey clearly demonstrated that great differences exist in cultivation area between spot market channel and direct market channel. The average farm scale under direct market group is over 16 times larger than that under spot market channel group. The close relationship between farm scale and farm specialization has been confirmed by Figure 4.2, which indicates that the larger the farms, the more specialized the farms. Here, farm specialization is represented by the percentage of household incomes from vegetable production, while farm scale is represented by the logarithm of multiplication of cultivation area with cropping intensity. The functional form of this regression is

quadratic. The analysis shows that farm scale is linked to farm specialization, which further relates to marketing channels. The relationships between farm scale and marketing channel choice are indirect and non-linear.

Figure 4. 2 Relationship between Farm Specialization and Farm Size



Single variable regression models only reflect the influence of separate factor in marketing channel decision, actually, marketing channel choice is simultaneously determined by many relevant factors. This study only concerned about those factors related to transaction costs. Because the number of relevant variables were too many to be included in a comprehensive model subject to the small survey sample, which was characterized with serious collinearity between explanatory variables, we regressed six factors found significant in the above single models in terms of several multivariate regression models, instead of regressing marketing channel choice on all of these

factors in one model. Firstly, we tested the significance of increased dependence arising from farm specialization, specific investment and quality inspection. Then, we tested the motivations of risk aversion and seeking farm service. Lastly, we analyzed potential consequences of closer vertical coordination for small farmers.

4.4.2 Driving Force Model

Farm specialization and food quality inspection are two major driving forces of closer vertical coordination in Chinese vegetable industry. Farm specialization may cause specialized farmers to depend more on their trading parties. From this perspective, it can be perceived as a kind of specific investment made by farmers. This kind of dependence can be partly reduced by market competition and technological advances. However, transport costs and timeliness are still the restrictive factors in vegetable marketing even in modern developed countries. Inelastic supply arising from vegetable perishability could lead to spatial monopoly and more opportunistic behaviours. This is a remarkable phenomenon in transition economies, where imperfect market institutions and infrastructure prevail. Once a specialization strategy is adopted, the specialized farms face more market risks. The higher percentage of incomes from vegetable production, the more specialized a farm, and the more specific this farm. In order to safeguard and avoid some market risks, specialized farmers are more likely to choose closer vertical coordination.

On the other hand, increasing concerns about food quality and safety from consumers has pushed food processors to adopt the quality assurance systems and the process control from farm to table. The imposition of strict pesticide residue test at the farmgate has stimulated specialized farmers to choose direct marketing to food processors to

avoid the potential refusal of their vegetables by food processors.

A binary Logit model has been established to test the significance of farm specialization and food quality inspection as driving forces of closer vertical coordination. In this model, the dependent variable is farmers' marketing channel choice, and it is a binary nominal variable. The explanatory variables include farm specialization, specific investment, and food quality inspection. Specific investment is a 5-grade ordinal variable, the higher grade means more investment made by farmers. The quality inspection is a nominal binary variable, that is, whether or not pesticide residue test is imposed.

Table 4. 5 Regression Results of the Driving Force Model

	Farm Specialization	Specific Investments	Quality Inspection	Constant
Coeff.	.08623	2.42341	4.06540	-14.0775
t	3.164	1.701	3.340	-4.453
(Sig.)	.0016	.0890	.0008	.0000
LR Test: Chi-squared statistic =68.90, df =3, critical value =11.34 when α =.01				

The Logit model has been estimated by using LIMDEP and SPSS softwares. The regression results are the same from these two softwares, and are reported in Table 4.5 above. Both softwares report the likelihood ratio test statistic--Chi-squared. The estimated Chi-squared of this model is 68.90, and the degrees of freedom are three. At the 0.01 significance level, the critical value of $\chi^2(3)$ is 11.35. The estimated Chi-square

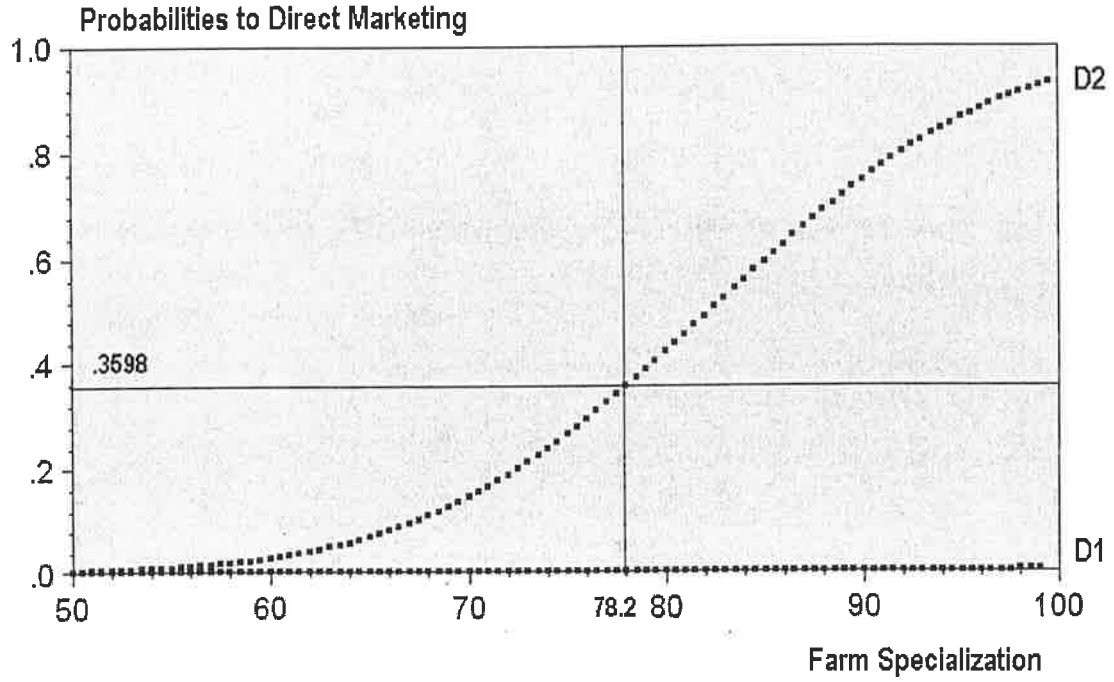
is substantially larger than the critical value. Therefore, we could reject the null hypothesis that all of slope coefficients are zero, and accept that the explanatory variables are jointly significant in explaining the variation of farmers' marketing channel choices.

All of slope coefficients are positive in this model, which demonstrates that these variables contribute positively to the choice of direct market channel. The coefficients of farm specialization and quality inspection are significant at the level of 0.01 in terms of t test, whereas the coefficient of specific investment is significant only at the 0.10 significance level, much lower than that of the single regression (sig =.001). The possible reason is the collinearity between specific investment and farm specialization in the survey sample. The correlation between these two variables is significant at the level of 0.01 for Pearson correlation, Kandall's tau_b, and Spearman's rho.

The marginal effects of the driving force model are reported in Table 4.6. Under the subgroup without quality inspection, all of coefficients are not significant. Under the subgroup with quality inspection as well as in all observations, the coefficients of both farm specialization and quality inspection are significant at the level of 0.01. However, specific investment is not significant under both situations. The marginal effect of farm specialization is 0.01046 in all observations, but it rose to 0.02147 under the subgroup with pesticide residue test. This demonstrates that it is the combination of farm specialization and quality inspection that drives specialized farmers to choose direct marketing channel to food processors. However, physical specific investments made by farmers are very small and not significant in explaining farmers' marketing channel choice.

If farm specialization increases from 50 to 100 percent, what are the probabilities for farmers to choose direct marketing channel. The simulation results are reported in Figure 4.3. The simulation compares the probabilities with and without food quality inspection. Without food quality inspection, even specialized farmers are less likely to choose direct marketing to food processors. D_1 stands for this situation, which lays just in the horizontal axis. With food quality inspection, specialized farmers are more likely to choose direct marketing, and the possibility increases quickly as farm specialization increases. D_2 represents this scenario. The probability curve has shifted dramatically due to the imposition of food quality inspection. The possibility for a farmer to choose direct marketing to food processors is 35.98 percent if farm specialization is at current sample average level (78.2 percent of household income comes from vegetable production).

Figure 4. 3 Farm Specialization and Quality Inspection as Driving Forces



As farm specialization increases, the possibilities to use direct marketing also rise. If a farm is totally specialized, there is 93.56 percent possibility for this farmer to use direct marketing if pesticide residual test is imposed. The above simulation is based on the assumption that physical specific investment is at current sample average level (1.29), which means that the farmers have made very little physical specific investment.

Table 4. 6 Marginal Effects of the Driving Force Model

Variables	Coefficient	t	Significance
Farm specialization	.01046	2.916	.0035
Specific investments	.29409	1.219	.2228
Quality inspection	.49335	2.579	.0099
Constant	-1.7083	-2.836	.0046

4.4.3 Risk Aversion Model

The vegetable growers face increasing market risks along with farm specialization. Price fluctuations in vegetable markets are very serious due to the inelastic vegetable supply and perishability, which could trigger more opportunistic behaviours by trading parties. The specialized vegetable growers are more vulnerable because their family incomes totally depend on vegetable production. As a result, stable market outlets and contractual arrangements become the attractive means to avoid some of market risks.

Risk avoidance as a major motivation for farmers to choose direct marketing channel can be demonstrated in the following risk aversion model. Based on the above driving

force model, physical specific investment is not a significant variable. Thus, it is omitted in our risk aversion model. In the risk aversion model, the dependent variable is farmers' marketing channel choice. The explanatory variables include farm specialization, price fluctuation, and quality inspection. Received price fluctuation is an ordinal variable with three values: 0 represents the change in transactional prices is below 10 percent annually; 1 represents the change is between 10 and 30 percent; and 2 represents the change is above 30 percent (see Appendix A on page 158).

The regression results of the risk aversion model are reported in Table 4.7 below. The estimated Chi-squared of this model is 73.41, and degrees of freedom are three. At the 0.01 significance level, the critical value of $\chi^2(3)$ is 11.35. The estimated Chi-square is substantially larger than the critical value. We could reject the null hypothesis that all slope coefficients are zero, and accept that farm specialization, price fluctuation, and quality inspection are jointly significant in explaining the marketing channel choice.

Table 4. 7 Regression Results of the Risk Aversion Model

	Farm Specialization	Price Fluctuation	Quality Inspection	Constant
Coeff.	.08075	-1.9535	5.19935	-6.88273
t	2.743	-2.473	3.387	-1.948
(Sig.)	(.0061)	(.0134)	(.0007)	(.0514)
LR Test: Chi-squared statistic =73.41, df =3, critical value =11.34 when α=.01				

The positive coefficients of farm specialization and quality inspection confirms that

these two variables contribute to the choice of direct marketing, which is the same as that in the above driving force model. The coefficient of price fluctuation is negative, which means that the received price fluctuations are negatively related to farmers' choice of direct marketing channel. In other words, the more likely farmers are to choose direct marketing channel, the less price fluctuation in their transactions can be expected. This is important evidence of farmers' motivation to choose direct marketing channel to food processors.

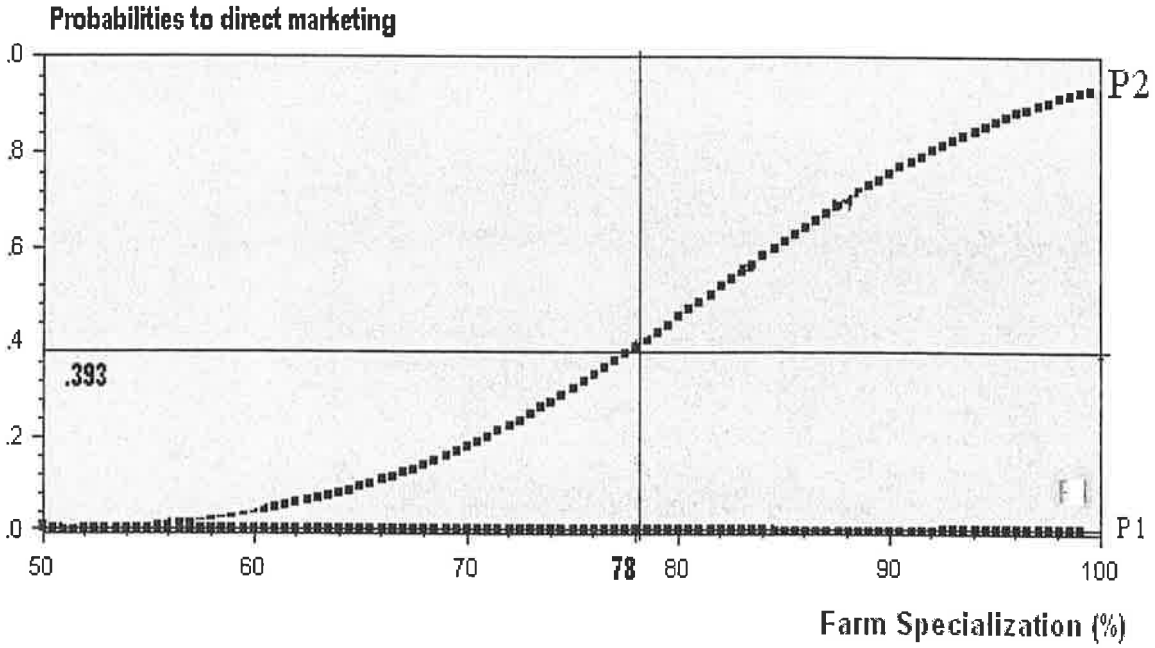
Table 4. 8 Marginal Effects of the Risk Aversion Model

Variables	Coefficient	t	Significance
Farm specialization	.00772	2.461	.0139
Price fluctuation	-.18674	-1.642	.1005
Quality inspection	.49700	2.313	.0207
Constant	-.65792	-2.368	.0179

The marginal effects of the risk aversion model are reported in Table 4.8 above. Under the subgroup without food quality inspection, all of the coefficients are not significant. Under the subgroup with food quality inspection, the coefficients of both farm specialization and quality inspection are significant at the level of 0.01, whereas the coefficient of received price fluctuation is significant at the level of 0.05. In all observations, the coefficients of both farm specialization and quality inspection are significant at the level of 0.05, while the coefficient of received price fluctuation is significant at the level of 0.10. The marginal effect of received price fluctuation is -

0.4829 with quality inspection, and is -.18674 if without quality inspection.

Figure 4. 4 Driving Forces of Direct Marketing in the Scenario of Risk Aversion

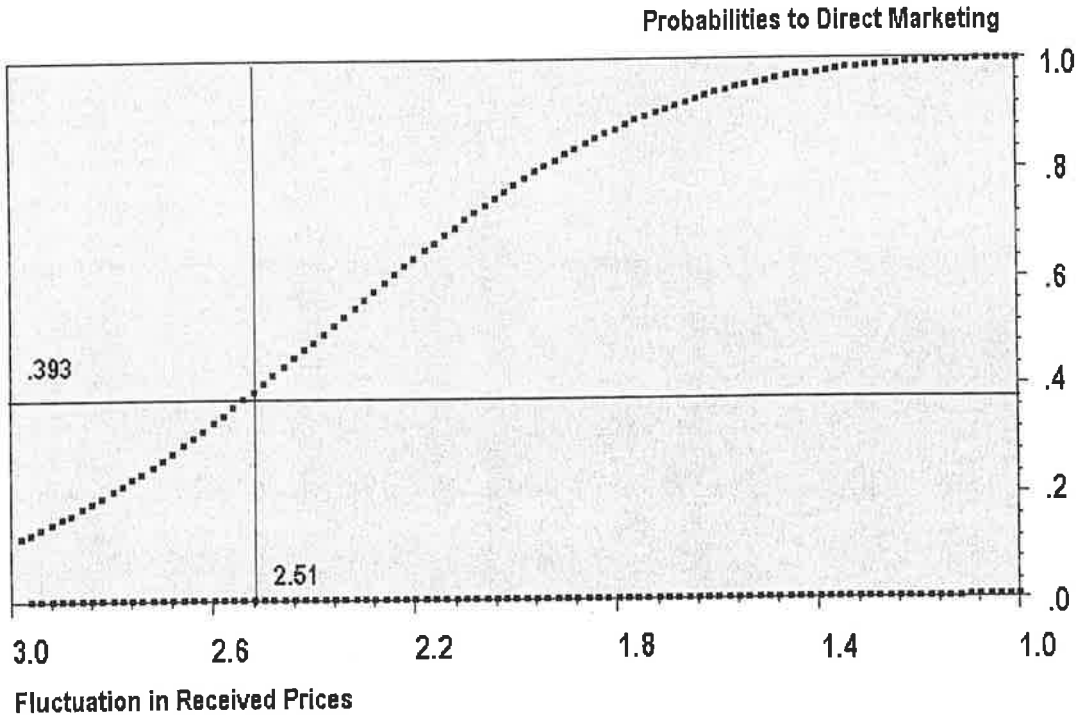


In the risk aversion model, farm specialization and quality inspection as the driving forces of closer vertical coordination have been also verified the same as in the driving force model. By keeping price fluctuation at the sample average level, the probabilities for farmers to choose direct marketing to food processors as farm specialization increases from 50 percent to 100 percent are simulated and reported in Figure 4.4 above. The simulation compares the probabilities with and without quality inspection. If no quality inspection imposed, even specialized farmers are less likely to choose direct marketing to processors. P_1 stands for this situation, just laying in the horizontal axis. If quality inspection is imposed, specialized farmers are more likely to choose direct marketing, and the possibility increases as farm specialization increases. P2 represents this scenario. The possibility for a farmer to choose direct marketing to

processors is 39.3 percent when farm specialization is at current sample average level. If this farm is totally specialized, the possibility to use direct marketing to processors is 93.14 percent, similar to the simulation value based on the driving force model.

The above simulation is based on the assumption that price fluctuation is kept at the sample average level (2.51), which means that the current transactional prices fluctuate greatly. Seeking stable transactional prices is an important motivation for farmers to choose direct marketing. Figure 4.5 simulates the relationships between the possibilities for farmers to choose direct marketing channel and the expected price fluctuation in their transactions. The more likely the farmers are to adopt this channel, the lower received price fluctuation they can expect.

Figure 4. 5 Less Price Fluctuation as a Motivation for Direct Marketing



4.4.4 Farm Service Model

Seeking farm services is another major motivation for specialized farmers to choose direct marketing to food processors. Farm services include provision of farm inputs and supervision of production and marketing. These activities are extremely important to small farmers in developing and transition economies. Firstly, farm specialization can improve agricultural productivity and then contribute to the growth of the economy. That is why many activities originally integrated within farms spin off into independent agribusiness. Secondly, the missing and imperfect markets in farm services are prevalent because of the public goods nature with some of farm services, and it is also because of imperfect market system during the transition period. Diseconomies of scale and high transaction costs prevent small farmers from engaging in these activities effectively and efficiently. Instead, private agribusiness firms can provide farmers with services more effectively and more efficiently.

Farm service is the bottleneck of vegetable industry development during commercialization, specialization, and institutional transition. Vegetable growers seek farm services from their contractors or food processors. A binary Logit model has been set up to explore the roles of seeking farm services in farmers' marketing channel choice. In this farm service model, the dependent variable is farmers' marketing channel choice. The explanatory variables include farm specialization, farm service, and quality inspection. Farm service is a 5-grade ordinal variable. The higher grade means the more farm services received from the contractors (Refer to Appendix A on page 158 for more details). We cannot incorporate price fluctuations in this model because of the collinearity between price fluctuation and farm service.

The regression results of the farm service model are reported in Table 4.9 below. The estimated Chi-squared of the model is 84.08. At the 0.01 significance level, the critical value of $\chi^2(3)$ is 11.35. The estimated Chi-square is substantially larger than the critical value. Therefore, we could reject the null hypothesis that all slope coefficients are zero, and claim that farm specialization, farm service, and quality inspection are jointly significant in explaining the variation of farmers' marketing channel choices.

The coefficients of farm specialization and quality inspection are positive as expected, and also highly significant. The coefficient of farm service is positive and significant at the level of 0.01 in terms of t test, which indicates that the received farm service is positively related to the choice of direct marketing to processors. The more farm services are provided by direct marketing channel, the more likely the farmers are to choose direct marketing to food processors.

Table 4. 9 Regression Results of the Farm Service Model

	Farm Specialization	Farm Services	Quality Inspection	Constant
Coeff.	.08921	3.26622	3.29229	-15.47078
t	2.789	2.602	2.429	-3.608
(Sig.)	(.0053)	(.0093)	(.0152)	(.0003)
LR Test: Chi-squared statistic =84.08, df=3, critical value =11.34 when α =.01				

The marginal effects of the farm service model are reported in Table 4.10 above. Without food quality inspection, the marginal effects of all variables are not

significant. With quality inspection, the marginal effect of farm specialization, farm service, and quality inspection is 0.01566, 0.57351, and 0.57808, respectively. In all observations, the marginal effect of farm specialization, farm service, and quality inspection is 0.01724, 0.63135, and 0.63639, respectively. The marginal effect of farm service is significant only at the level of 0.11 in all observations, whereas, significant at the level of 0.002 if quality inspection is imposed, which indicates that farm services become more important for specialized farmers as food quality and safety issues emerge.

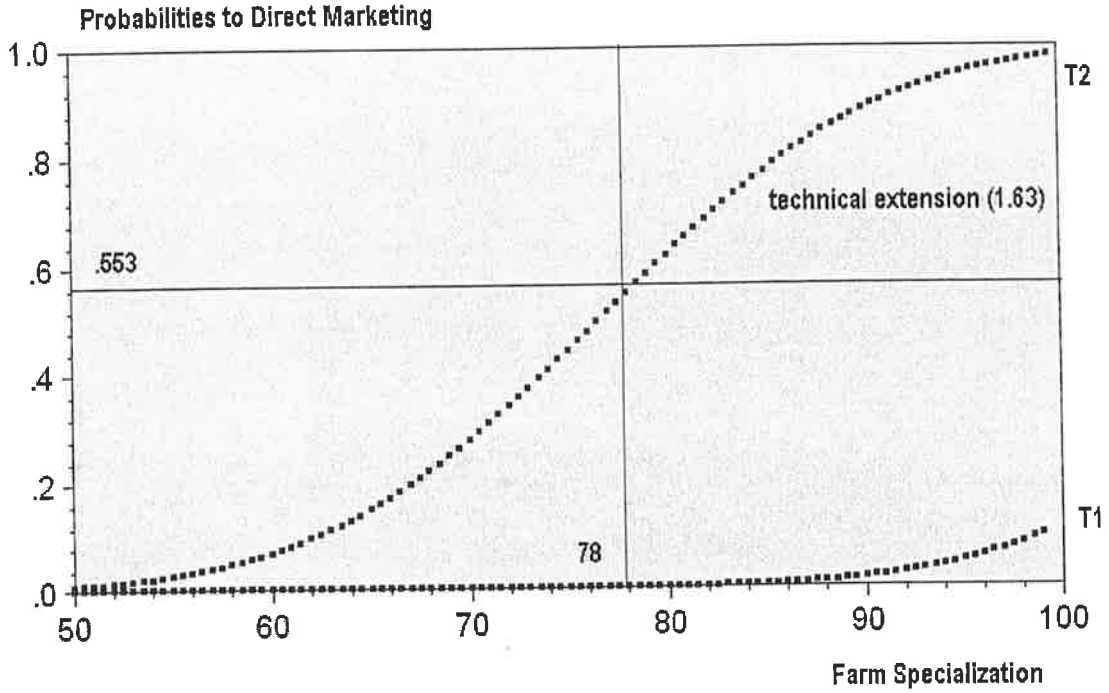
Table 4. 10 Marginal Effects of the Farm Service Model

Variables	Coefficient	t	Significance
Farm specialization	.01724	2.391	.0168
Farm services	.63135	1.597	.1102
Quality inspection	.63639	2.250	.0245
Constant	-2.99045	-2.494	.0126

By keeping farm service at the sample average level, the probabilities for farmers to choose direct marketing to food processors as farm specialization increases from 50 percent to 100 percent are simulated and reported in Figure 4.6. The simulation compares the probabilities with and without quality inspection. If no quality inspection imposed, even highly specialized farmers are less likely to choose direct marketing. This situation is represented by $\mathbf{T_1}$. If quality inspection is imposed, specialized farmers are more likely to choose direct marketing, and the possibility increases as farm

specialization increases. T_2 represents this scenario. The possibility for a farmer to choose direct marketing is 55.3 percent if farm specialization is at current sample average level. If a farmer is totally specialized in vegetable production, the possibility for this farmer to choose direct marketing channel is 99.9 percent.

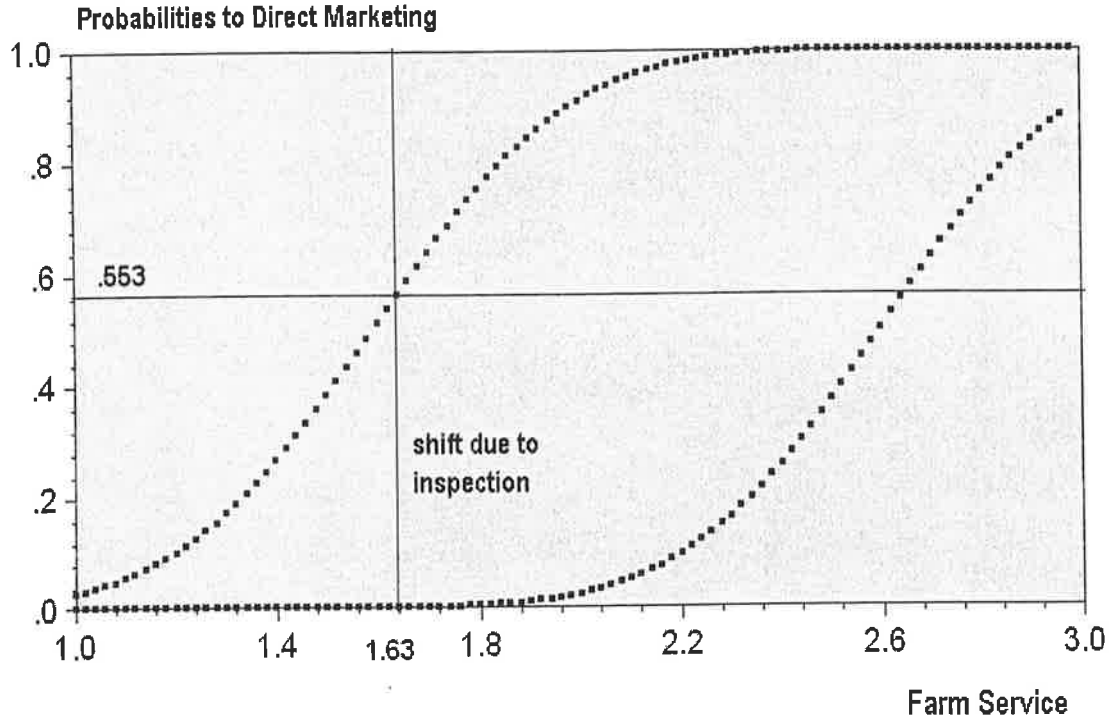
Figure 4. 6 Driving Forces of Direct Marketing in the Scenario of Farm Services



The above simulation is based on the assumption that farm service is at the sample average level, which means that the current farm service from contractors is still quite little. If the contractors or food processors could provide more farm services, then more farmers are expected to choose direct marketing channel. This scenario has been simulated in Figure 4.7 by keeping farm specialization at sample average level (78 percent). It can be seen that, without quality inspection, only if contractors or processors provide small farmers with more than moderate farm service, are these farmers likely to choose direct marketing channel. However, with quality inspection,

these farmers may shift to direct marketing much earlier when they could receive just little farm service from food processors.

Figure 4. 7 Seeking Farm Services as a Motivation to Choose Direct Marketing



4.4.5 Bargaining Power Model

The above three models confirm that farm specialization together with the imposition of pesticide residue test at the farmgates have made vegetable growers more likely to use direct marketing channel as an instrument to avoid market risks and to seek farm services under the circumstance of institutional transition and agricultural transformation. However, the closer vertical coordination along the food supply chains may bring significant consequences, one of which is the declining bargaining powers by the specialized small farmers. In this section, the bargaining power model has been established to test this.

The dependent variable of the bargaining power model is farmers' marketing channel choice, and the two explanatory variables are farm specialization and farmer's bargaining powers. Farmers' bargaining power is a 5-grade ordinal variable, the larger the grade, the stronger the bargaining power by farmers. The basic idea of this model is that as farm specialization increases, the vegetable growers are more likely to use direct marketing channel. If they use direct marketing channel, their bargaining powers may decline.

A binary Logit model is used to test the above possible relationships. The regression results of the bargaining power model are reported in Table 4.11 below. The estimated Chi-squared of the model is 104.65, and the degrees of freedom are two. At the 0.01 significance level, the critical value of $\chi^2(2)$ is 9.21. Clearly, the estimated Chi-squared is greatly larger than the critical value. Therefore, we could reject the null hypothesis that both slope coefficients are zero, and accept that farm specialization and bargaining power are jointly significant.

Table 4. 11 Regression Results of the Bargaining Power Model

	Farm specialization	Bargaining power	Constant
Coeff.	.12627	-3.35864	-3.81990
t	2.379	-2.940	-1.031
(Sig.)	.0173	.0033	.3025
LR Test: Chi-squared = 104.65, df = 2, significance = .0000			

The positive and significant coefficient of farm specialization is just the same result as

in the above models. The coefficient of farmers' bargaining power is negative and significant at the level of 0.01 in terms of t test, which indicates that farmers' bargaining power declines when they use direct marketing channel to food processors. From the summary of the household survey (see Table 4.1), the average value under the group of direct marketing channel to food processors is grade 1 based on 5-grade ranking, which means that farmers can accept only passively the prices set by the processors. In contrast, the average value under the group of wholesale market is grade 5, the highest grade. Even if farmers sell their vegetables to the middlemen, their bargaining power averaged grade 4.

Table 4. 12 Marginal Effect of the Bargaining Power Model

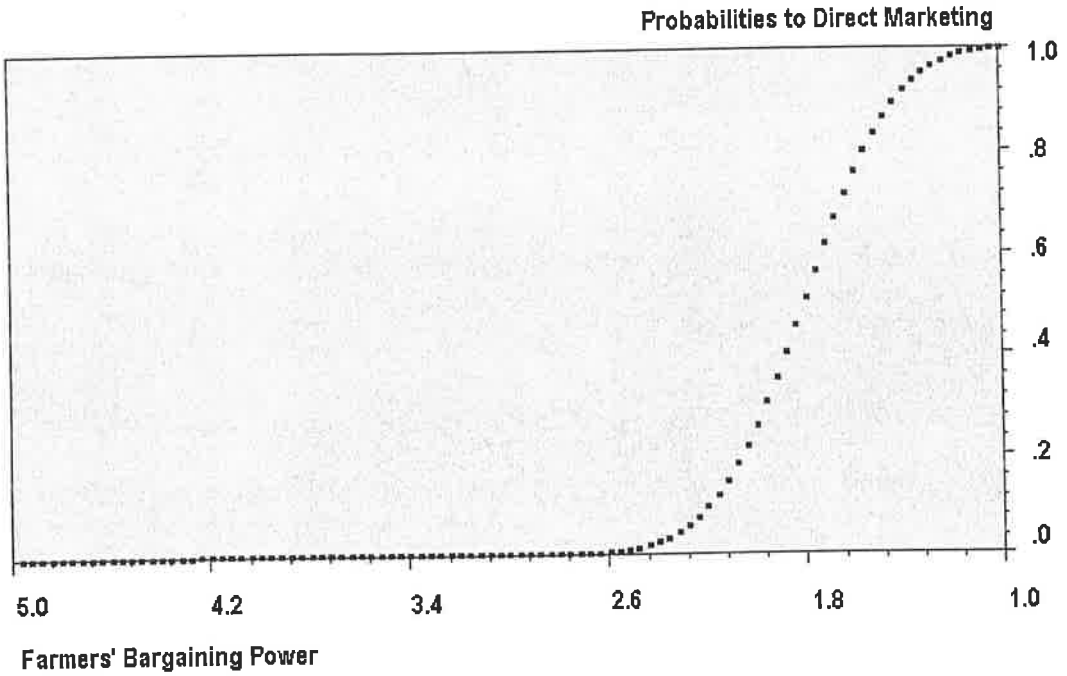
Variables	Coefficient	t	Significance
Farm specialization	.00137	.648	.5167
Bargaining power	-.03636	-.673	.5008
Constant	-.04135	-.590	.5549

The marginal effects are not significant under the subgroup without food quality inspection as well as in all observations. Under the subgroup with quality inspection, the marginal effect of farm specialization and bargaining power is 0.01721 and – 0.45773, respectively, both of them are significant at the level of 0.15 (see Table 4.12).

By keeping farm specialization at the sample average level, we have simulated the probabilities for the vegetable growers to use direct marketing channel and the possible implications for their bargaining power. Figure 4.8 shows the negative relationship

between the usage of direct marketing channel and the bargaining power by farmers. The simulation indicates that if a farmer chooses direct marketing channel, his bargaining power is surely below grade 3--the moderate bargaining power. If he definitely chooses direct marketing channel, his bargaining power probably is grade 1--only passively accept food processors' prices.

Figure 4. 8 Negative Relation between Bargaining Power and Direct Marketing



4.5 Summary

This chapter attempts to explain why farmers increasingly shift their coordination mechanism from open spot market to the contractual arrangements, or equivalently in this study, why farmers shift their marketing channels from middlemen and wholesale market to direct marketing channel. The basic arguments are based on the transaction cost approach that the relative changes in transaction costs among the alternative marketing channels have caused this shift. Without trying to measure the transaction

costs, we have adopted an indirect approach.

The fundamental factors, which have caused the changes in transaction costs, include the increasing farm specialization and the imposition of pesticide residue testing at the farmgates, which made the transaction costs with the market channel (including the middlemen and the wholesale market) relatively higher than those with the direct market channel to food processors. Farm specialization and food quality inspection further stimulate farmers to seek effective ways to avoid market risks and to receive farm services. These motivations can be satisfied with the direct marketing channel to food processors in terms of lower transaction costs than other alternative channels. These relationships have been proved by the driving force model, the risk aversion model and the farm service model. The potential consequences of closer vertical coordination have been also discussed in terms of the bargaining power model.

5. VEGETABLE SUPPLY CHANNEL CHOICE—CONJOINT ANALYSIS

5.1 Introduction

As more processed and semi-processed horticultural products are demanded by both domestic and foreign markets, food processors become increasingly important players in horticultural supply chains. Food processors usually act as channel captains of food supply chains. They usually buy fresh vegetables from alternative supply channels. The hold-up issues as well as recently emeged food safety concerns triggered the changes in vegetable procurement arrangements by food processors.

Food processors can purchase fresh vegetables from middlemen, or from wholesale markets, or directly from farmers. Their choice among the alternative supply channels mainly depends on the following considerations. Firstly, whether the channel can keep stable supply of vegetables, which is essential for the capacity utilization and the scale economies of the processors. Secondly, whether the channel is characterized with low transaction costs, which is particularly important for horticultural products due to the high proportion of transaction costs in the retailing prices. Thirdly, whether the channel is able to guarantee food quality and safety, which is critical in the context of globalisation and fierce international competition.

Just as goods and services can be viewed as bundles of attributes (Lancaster 1966), vegetable supply channels also display different attributes or characteristics. From the perspective of transaction costs, some attributes are transaction costs generating while others are transaction costs saving. Food processors have to make a trade-off between attribute levels to minimize transaction costs and to maximize the total utility.

Conjoint analysis is a multivariate technique for finding out how buyers make trade-offs among competing products or suppliers (Green et al. 2001). Using conjoint analysis, researchers can answer such questions as what product attributes are important and what levels of the product attributes are the most desirable. Researchers can further predict how the buyers will choose from the alternative products and suppliers with the help of choice simulator. This kind of simulation is particularly useful to understand buyers' reactions to and evaluations of pre-determined attribute combinations that may represent potential products and services (Hair et al. 1995).

The choice decision reflects food processors' preference structure and their trade-offs among the attributes. In the context of speeding farm specialization and trade liberalization, saving transaction costs and guaranteeing food quality and safety are essential for maintaining or gaining the competitive advantage, which significantly influence food processors' choice of supply channels. This study has selected four attributes with vegetable supply channels, that is, testing fees for pesticide residues in vegetables; traceability from processors to vegetable growers; trust between food processors and vegetable growers; and how difficult for food processors to monitor vegetable growers. The survey for this conjoint analysis was conducted in Laiyang city.

Next section briefly introduces the methodology of conjoint analysis. Section 3 applies conjoint analysis to analyze the supply channel choice by food processors. Section 4 further discusses the related issues based on the results of the conjoint analysis. The last section concludes this chapter.

5.2 Methodology of Conjoint Analysis

Conjoint analysis has evolved from the seminal work by psychometric researchers (Luce and Tukey 1964). The approach then has been successfully applied in marketing research since the 1970s (Green and Srinivasan 1978, 1990; Carroll and Green 1995; Green et al. 2001). Facilitated by the widespread introduction of computers and by the availability of conjoint softwares, this approach has been widely used for commercial purposes in the United States and Europe (Cattin and Wittink 1982; Wittink and Catin 1989; Wittink et al. 1994). Over the last three decades, thousands of applications have been carried out, the majority of which focused on new product evaluation, competitive analysis, and market segmentation. There were also some applications in marketing channel choices and supply chain designs (Hobbs 1996).

Conjoint analysis is a decompositional approach to finding out how consumers make trade-offs among competing products with multiattributed characteristics. The basic assumption of this approach is that consumers evaluate the total utility (total worths) of a product by combining the separate part utility (part-worths) for attribute levels of that product. Researchers at first develop a set of alternative products (real or hypothetical) in terms of bundles of attributes through fractional factorial designs. These real or hypothetical products are then presented to the consumers during the survey. And the consumers are asked to rank, order or rate these alternatives. Because the products are represented in terms of bundles of attributes at mixed "good" and "bad" levels, the consumers have to evaluate the total utility from all of the attribute levels simultaneously to make their judgements. Based on these judgements, the researchers can estimate the part-worths for the attribute levels by assuming certain composition

rules. Then the part-worths are used to calculate the relative importance of each attribute and formulate the consumer-choice simulator for prediction purpose (Green and Srinivasan 1990; Hair et al. 1995; Green et al. 2001). Conjoint analysis is usually composed of the following steps:

5.2.1 Selection of Attributes and Levels

Both economists and psychologists suggest that products can be defined as bundles of attributes (Lancaster 1966; Fishbein 1967). While consumers may have heterogenous preferences over these attributes, the same decision issue facing all of consumers is how to trade off the possibility that product X is better than product Y on attribute A, while product Y is better than product X on attribute B (Green et al. 2001). A consumer's decision to choose product X over product Y is determined by his/her underlying preference structure. The purpose of conjoint analysis is to reveal the consumer's preference structure, and then use this empirical information to simulate how consumers will react to the bundles of attributes, which may represent potential new products.

Any product may be represented by lots of attributes; depending from which perspective, you view. Therefore, the selection of attributes and levels for a product is basically determined by the specific purpose of the research. The researchers must first be sure to define the total worth of the product. And all of the selected attributes and levels should have significant impacts on the consumer choice decision. The selection of attributes and levels must satisfy several general requirements, such as, actionable and communicable attributes, balanced and reasonable ranges of attribute levels, avoidance of interattribute correlation (Hair et al. 1995).

5.2.2 Fractional Factorial Design

The products are described in terms of combinations of attributes at mixed levels in conjoint analysis. These combinations are also called profiles or experimental stimuli. The consumers are asked to rank, order or rate these alternative profiles during the survey. However, the number of possible combinations of the attributes is usually too large for the consumers to make meaningful judgement. Therefore, the researchers need to reduce the number of profiles presented to the consumers while still maintaining orthogonal among the part-worth estimates. Fractional factorial design is used for this purpose, which produces only subsets of complete possible combinations of the attributes. Such kind of subsets is called orthogonal arrays, in which only main effects are considered while interactions are assumed negligible.

5.2.3 Data Collection by the Survey

In conjoint analysis, the independent variables and their values are predetermined by the researchers during the conjoint experimental designs. These independent variables are nonmetric or categorical variables. The dependent variable is the consumer choice decision or the consumer overall evaluation on the alternative profiles. The researchers present the profiles to the consumers during the survey to ask the consumers to rank, order, or rate these alternative profiles. The results of the ranking, ordering or rating by the consumers constitute the observation data for the dependent variable—the only data needed to collect for conjoint analysis. The survey for conjoint analysis could be conducted by personal interviews, by mail or by phone.

5.2.4 Estimation of Conjoint Model

During the survey, the consumers are asked to provide only their overall evaluations on the alternative profiles by ranking, ordering, or rating. Unlike the expectancy-value model (a compositional approach in nature), conjoint analysis is a decompositional approach. The consumers do not need to tell the researchers anything else, such as, how important is the specific attribute level to the consumer, because the researchers have constructed the real or hypothetical products in a specific manner, so that the part-worths for attribute levels and the relative importance of each attribute can be inferred from the consumers' overall evaluations in terms of ranking, ordering or rating.

In order to estimate the conjoint model, researchers have to assume the composition rule and have to specify the types of the part-worth relationships. The most often used compositional rule is additive rule, which assumes the consumer just "add up" the part-worths for attribute levels to calculate the total worths of a product. There are four types of the part-worth relationships between the consumer preference and the attribute levels: linear, quadratic, part-worth, and mixed model. The linear relation indicates that the consumer preference increases or decreases with increasing value of the attribute. The quadratic relation assumes that the preference is maximal at the ideal and then decreases when moving away from it. The part-worth relation assumes each level of the attribute has a unique part-utility relationship associated with it. The mixed model just combines all of the above three types of relationships (Green and Srinivasan 1978).

5.2.5 Consumer Choice Simulation

The results of conjoint estimation are traditionally applied in three major fields: market segmentation, competitive analysis, and choice simulation. The part-worths estimates

can be used to formulate the consumer-choice simulator to predict how consumers might react to the bundles of attributes, which represent potential new products. The choice simulation follows three-step process: (1) estimate and validate conjoint model for each consumer; (2) select the sets of stimuli to test according to possible competitive scenarios; and (3) simulate the choices of all consumers for the specified sets of stimuli and predict market share for each stimulus by aggregating their choices (Hair et al 1995). There are four alternative rules to be selected for simulation purpose: (1) maximum utility; (2) Bradley-Terry-Luce (BTL); (3) Logit, and (4) alpha.

5.3 Application to Supply Channel Choice

The two basic assumptions for conjoint analysis are: (1) a product can be perceived as a bundle of attributes; (2) a consumer evaluates the total utility of a product simply by combining the separate part utility for the attributes of the product. Hobbs (1996) argued that a supply channel could be also viewed as a bundle of attributes, just similar to a product. A food processor evaluates the total utility of a supply channel by combining the separate part utility for the attributes of the channel. The food processor's choice among the alternative supply channels depends on his overall evaluation of the alternative channels, and fundamentally determined by his preference structure. Conjoint analysis can empirically reveal his preference structure.

To conduct this conjoint analysis, the total utility function for the food processor should be defined firstly. In this study, we assume that transaction costs and quality assurance are the major determinants of the total utility with supply channels. This assumption can be justified by the fact that transaction costs account for the majority of retailing price of horticultural products, any significant reduction of transaction costs in

horticultural marketing and distribution means the improved firm profitability. On the other hand, quality assurance is becoming the priority of food processors in the context of increasing concerns about food quality and safety from both domestic and foreign consumers. The quality assurance and the corresponding organizational innovations may trigger the relative changes in transaction costs with the alternative supply channels. The stricter quality control could mean higher transaction costs spent on the supply chains. Both transaction costs and quality assurance are the significant determinants of the competitiveness of a food processor. Trade-offs must be made by food processors during their decisions on supply channel choices. Which attributes are more emphasized by food processors in the context of speeding agricultural commercialization and trade liberalization? Conjoint analysis could help to answer such questions.

5.3.1 Selection of Attributes and Levels

Once the total utility function for food processors has been defined, all of those factors, which significantly influence transaction, costs and quality assurance should be included in the bundle of attributes. Among these attribute levels, some are transaction costs generating, some are transaction costs saving, the former creates the negative utility, the latter brings positive utility for the food processor. Food processors choose among the alternative channels in order to maximize their total utility with the supply channels, that is, to minimize the transaction costs while assuring the quality and safety of their food products.

Many factors affect transaction costs and quality assurance with supply channels. According to transaction cost economics, the major sources of transaction costs come

from information costs, negotiation costs and monitoring costs. The organization of a supply channel has significant impacts on the types and levels of transaction costs with the channels. It also influences the capability for a food processor to control the quality and safety of his final food products through these channels. Considering the restrictions on the numbers and other general requirements on the attributes and levels, we have selected 4 attributes with 2 balanced levels characterized with a supply channel, that is, test fees for pesticide residue in vegetables per unit of product; traceability from the processor to the vegetable growers; trust between food processors and vegetable growers; difficulty for the food processor to monitor their customer farmers. All of these attributes are transaction costs related.

The first attribute is test fees for pesticide residue in vegetables. From the food processors' perspective, test fees are quite different and can be distinguished among the alternative supply channels. For the supply channel via middlemen, the test fees at each unit of vegetables are very high because of small batch of transactions with small households. In contrast, if the processor procures from wholesale markets or from large farms, the test fees at each unit of products are much lower thanks to the large transaction quantity each time.

The second attribute is traceability from the processor to the vegetable growers. In the context of emerging concerns about food quality and safety, food processors do care about how fresh vegetables are procured, because it affects the quality of their final products. In order to encourage high quality suppliers and avoid low quality suppliers, food processors must get to know who is the original producer for this batch of vegetables. If food processors can easily trace back to the original producers, they can

screen out the quality suppliers at low information costs. Apparently, it is very difficult to trace back with spot market, and quite easy to trace back with direct marketing.

The third attribute is trust between food processors and the vegetable growers, which is a particularly important factor in the context of transition economies, where missing market institutions are popular and hold-up between food processors and farmers prevails. When the market price is higher than the contract price, farmers may breach their contracts and sell their vegetables to the market, not to the contractors. In contrast, if the market price is lower than the contract price, food processors may also breach their contracts and procure the vegetables from the market at cheaper price. Lack of trust could be a disaster not only for food processors, but also for farmers. Trust between food processors and farmers could greatly save transaction costs, and reduce the uncertainty of their exchanges. Therefore, the supply channel characterized with high trust is desirable.

The last attribute is the level of difficulty for food processors to monitor their client farmers. In contract farming, food processors have some management powers. This is different from the classical market contract, which defines only buying and selling relations. As vertical coordination becomes more advanced, farmers delegate more powers to food processors, and consequently, food processors will supervise or monitor the activities of farm production in terms of technical promotion or even direct control of farm operational decisions. This kind of contract is becoming popular as food quality and safety issues emerge. As for vegetables, pesticide residue and planting schedule are typically concerned by food processors, because food processors need balanced vegetable supply to keep their capacity usage at high level, which requires farmers to

plant their vegetables scheduled by food processors.

According to Hair et al. (1995), balanced levels are preferred in conjoint analysis, especially for the estimation of the relative importance of the attributes. Hence, two balanced levels are assigned to each attribute in this study: "high" and "low" for the test fees; "difficult" and "easy" for the traceability; "bad" and "good" for the trust; and "difficult" and "easy" for the monitor.

5.3.2 Fractional Factorial Design

The complete factorial combinations for four attributes with two levels are 16 (2^4 =16). It is difficult for the food processor to rank, order or rate all of these combinations meaningfully during the survey. For this reason, fractional factorial design is used to generate orthogonal arrays—subsets of all possible combinations of the attribute levels, which consider only main effects of the factors. The selected orthogonal array in this study has been produced with SPSS software (see Table 5.1). The chosen orthogonal array contains 10 combinations (profiles), the first eight of them are for conjoint estimation, and last two combinations are holdout for model validation purpose.

These combinations are not the exact proxies of the real supply channels, but they are abstracted from real supply channels. Take the first combination as an example: *low test fees* for pesticide residue in vegetables per unit of product may indicate that the quantity of each transaction is large. The possible trading parties with food processors in this case may be large scale farmers or wholesalers; *difficult traceability* to the original producers may be represented by spot market, such as the channel via wholesalers, who can transform small transactions into large transactions, but they are difficult to trace back the original producers; *Good trust* existing between food

processors and sellers implies that the specific investments for the transactions are significant. This could be the highly specialized vegetable grower. High specialization in perishable vegetable production has made them more vulnerable and dependent on food processors. Thus, they value the relationships with food processors. And they are more *easily monitored* by processors.

Table 5. 1 Orthogonal Design for Conjoint Analysis

Case	Test fees per unit of product	Traceability to original producers	Trust between processors and farmers	Ability to monitor farmers' activities
1	Low	Difficult	Good	Easy
2	High	Easy	Bad	Easy
3	High	Difficult	Good	Difficult
4	Low	Easy	Good	Difficult
5	Low	Easy	Bad	Difficult
6	Low	Difficult	Bad	Easy
7	High	Difficult	Bad	Difficult
8	High	Easy	Good	Easy
9 (H)	High	Easy	Good	Difficult
10(H)	High	Difficult	Good	Easy

5.3.3 Data Collection by the Survey

To collect data for the conjoint analysis, the survey has been conducted in Laiyang city, Shandong province. The survey covered almost all of formal food processors in this

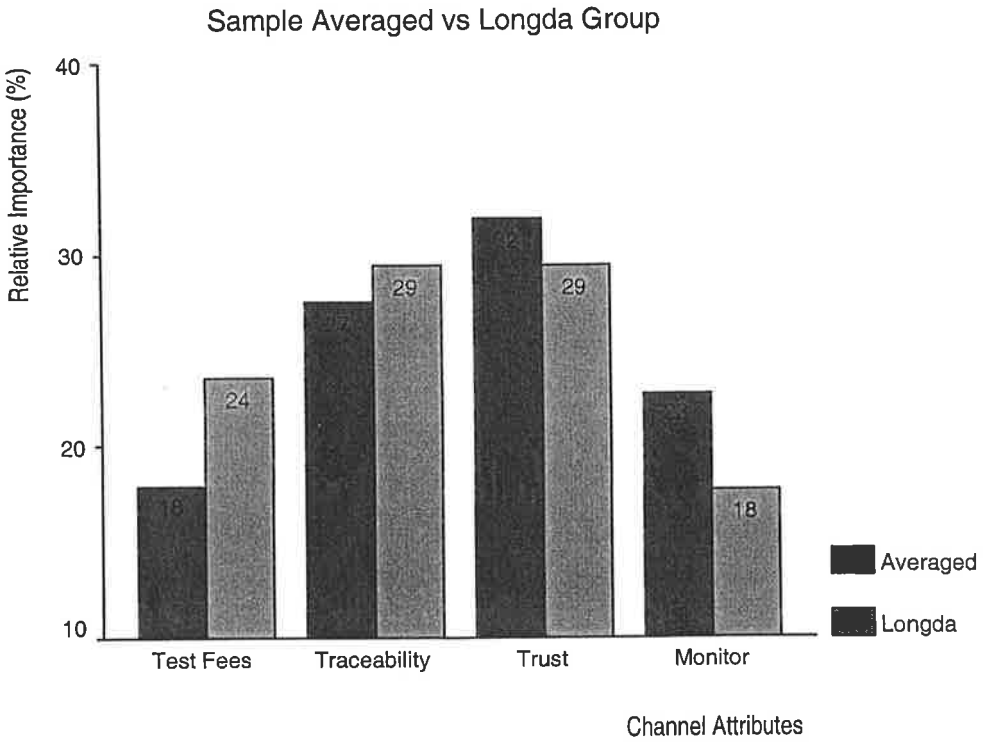
City. Although the sample size is small, the sample is quite typical for the region where increasingly specializes in producing and exporting horticultural products. The farm specialization and trade liberalization have significantly influenced the organization of agri-food systems in such kind of regions. The survey questionnaire for food processor is based on the above orthogonal design (see Appendix B on page 159). Food processors are asked to rank the 10 combinations. The most preferred combination ranks 1, while the least preferred combination ranks 10.

5.3.4 Estimation of Conjoint Model

In order to estimate the conjoint model, firstly we have to assume the composition rule and the types of relationships between preferences and the attribute levels. In this study, the additive rule and the linear relationships between the preferences and the attribute levels have been assumed. SPSS software has been used to estimate the part-worths for the attribute levels and the relative importance of the attributes. The results of conjoint analysis are reported in Figure 5.1 and Table 5.2.

The part-worths for the eight attribute levels have been estimated for the 52 food processors, respectively. But Table 5.2 only reports the estimates for the sample average and a typical large food processor—Longda Group. The estimates are normalized, and they can be compared each other. For all of the negative attribute levels, the part-worths are assigned as zero. For the positive attribute levels, the larger the coefficients, the more important this attribute is for channel choice decision. It can be seen that the trust has the largest coefficient, which implies that the trust is the most emphasized factor. In contrast, large food processors emphasize the traceability factor. The part-worth estimates for traceability and trust are just the same for Longda Group.

Figure 5.1 Relative Importance of Four Attributes with Channels



Based on the part-worth estimates, conjoint procedure can further deduce the relative importance of each attribute in the choice decision. The results of conjoint analysis demonstrate that trust and traceability are the dominant factors among the four attributes concerned in this study. For the sample average, the most important attribute is the trust between food processors and the vegetable growers, which accounts for 31.86 percent among the total importance. The second important attribute is the traceability from food processors to the vegetable growers, accounting for 27.47 percent. The third attribute measures the ability for food processors to supervise and monitor farmers activities (22.74 percent). The last attribute is the fees spent on testing pesticide residue in vegetables (17.93 percent). In comparison with the sample average, large food processors emphasize more on the traceability and the test fees, because they are usually export-oriented food processors, and more concern about the emerging food

quality and safety issues. For example, Longda Group values traceability 2 percentages higher, and values the test fees 6 percentages higher than the sample average.

Table 5. 2 Results of Conjoint Analysis: Sample Averaged and Longda Group

Attributes and Levels	Utility (Part-Worths)		Relative Importance (%)	
	Sample Averaged	Longda Group	Sample Averaged	Longda Group
Test Fees			17.93	23.53
High	0.00	0.00		
Low	0.8413	2.00		
Traceability			27.47	29.41
Difficult	0.00	0.00		
Easy	2.1490	2.50		
Trust			31.86	29.41
Bad	0.00	0.00		
Good	2.4760	2.50		
Monitor			22.74	17.65
Difficult	0.00	0.00		
Easy	1.7837	1.50		
Constant	0.8678	0.250		
Pearson's R	0.990	0.945		
Kendall's tau	1.000	0.857		
Kendall's tau (holdout)	1.000	1.000		

Pearson's R and Kendall's tau have been reported in Table 5.2 for the sample average and Longda Group, respectively. These correlation coefficients demonstrate that the fitness of the model is excellent. Furthermore, two holdout combinations are

specifically designed for model validation purpose. The high values of Kendall's tau for holdouts confirm the validity of the model.

To further explain the model test and validation, we take Longda Group as an example (see Table 5.3). We know that the part-worth estimates indicate the influence of a specific attribute level on the food processor's preference for a particular combination. If the additive composition rule is assumed, the total sum of the part-worths for all attributes in a combination, plus the constant given by the conjoint estimation, are the total utility of this combination. The total utility is a measurement of preference, the larger the total utility for a particular combination, the higher the rank for this combination. The estimated ranks and the actual ranks of the combinations can be compared in terms of correlation coefficients, which measure the accuracy of the conjoint model estimation. For Longda Group, Pearson's R and Spearman's rho are 0.948, Kendall's tau is 0.854.

Table 5. 3 Estimated Rank and Actual Rank: Longda Group

Case	Total utility	Estimated rank	Actual rank
1	6	3	3
2	4	6.5	8
3	2.5	9	9
4	7	1	2
5	4.5	5	6
6	3.5	8	7
7	0	10	10
8	6.5	2	1
9	5	4	4
10	4	6.5	5

5.3.5 Channel Choice Simulation

The estimated part-worths for the attributes can be further used to formulate the channel choice simulator to predict how food processors will choose among the potential alternative supply channels, which may have some useful policy implications. In this study, we assume three possible alternative vegetable supply channels for simulation purpose. The first supply channel is with all negative attribute levels: high test fees per unit of product; difficult to trace back the quality and safety; no trust between the trading parties; and difficult for food processors to monitor the farm activities. This kind of supply channel can represent spot market, particularly small diversified farmers via middlemen. The second channel is with all positive attributes except for high test fees for pesticide residue, which could represent large farmers via few agents. And the third channel is with all positive attributes, which may be represented by direct marketing channel from large organic farms to processors.

The simulations tell us if food processors have opportunities to choose from these three alternative supply channels, what decision they possibly make. The choice simulator is based on the above conjoint analysis. Three choice rules are adopted for the simulations: maximum utility, BTL and Logit. The simulation results in Table 5.4 show that among three alternative channels, almost no food processor likes to choose the first channel (spot market). For the second channel, the results are somewhat inconvergent, arranging from 13.46 to 44.66 percent of food processors may choose this channel, depending what choice rule adopted. For the third channel, 50 to 86.5 percent of food processors possibly choose this channel.

Table 5. 4 Results of Conjoint Simulations

	Channel 1	Channel 2	Channel 3
Channel Characteristics			
Test Fees	High	High	Low
Traceability	Difficult	Easy	Easy
Trust	Bad	Good	Good
Monitor	Difficult	Easy	Easy
Preference Scores			
Whole Sample	0.90	7.30	8.10
Longda Group	0.30	6.70	8.70
Probabilities Chosen			
Max Utility	0.00	13.46	86.54
BTL	5.27	44.66	50.07
Logit	0.21	31.67	68.11

5.4 Further Discussions

In this conjoint analysis, the four attributes concerned are all related to the transaction costs with vegetable supply channels. The alternative combinations of the attribute levels may represent the different levels of transaction costs. If the preferences given by food processors are consistent with the levels of the transaction costs with these combinations, our hypothesis in this study—the food processor choose among the alternative supply channels to minimize the transaction costs—can be confirmed. The conjoint simulations can provide us with preference scores for the alternative

combinations, which is an excellent proxy of the preferences by food processors. The difficult issue is the measurement of transaction costs with the alternative combinations. However, we only need to rank the levels of transaction costs with these combinations. Thus, the indirect approach would be enough for this purpose.

Conjoint simulations demonstrate that the preference scores given by sample average for channel 1, channel 2, and channel 3, are 0.9, 7.3 and 8.1, respectively. Preference scores given by Longda Group for these three channels are 0.3, 6.7 and 8.7, respectively. Among these three alternative channels, preferences by food processors are quite clear: channel 3 is most preferred, channel 1 is least preferred, and channel 2 is suboptimal channel with relatively high preference scores .

What about the relative levels of transaction costs with these three alternative supply channels? The test fees for pesticide residue in vegetables are the sources of information costs. The ability for the food processor to trace back and monitor the vegetable growers affect the monitoring costs. Lack of trust and potential hold-up are the direct sources of transaction costs. The transaction costs are necessarily high for the supply channel with such characteristics as high test fees, difficult traceability, lack of trust, and difficult to monitor the contract producers. On contrary, if the supply channel is characterized with low test fees, easy traceability, trust, and easy monitoring, such as channel 3, the transaction costs must be low. Among the three alternative channels, channel 2 is the same as channel 3 except the high test fees. We can conclude that the relative level of transaction costs with these three channels: channel 3 < channel 2 < channel 1. This ordering is just the same as that of the preference scores given by food processors in the conjoint simulations.

The conjoint simulations predict the probabilities for food processors to choose from alternative channels. The probability for food processors to choose channel 1 is nearly zero. In contrast, the probability for food processors to choose channel 3 is very high, 86.5 percent if the utility maximum rule is used, 68.1 percent, if the Logit rule is used, and 50 percent if BTL rule is used. Apparently, food processors will choose channel 3 against channel 1. However, the choice between channel 3 and channel 2 is not so clear if BTL rule is used: the probabilities to choose channel 3 is 50 percent, while the probabilities to choose channel 2 is 44.7 percent. If the utility maximum rule or the Logit rule is used, food processors significantly prefer channel 3 against channel 2.

Based on the above analysis, we can conclude that our hypothesis is confirmed in this study. Food processors prefer the supply channel with low transaction costs. Even if the food quality and safety issues have been emerging recently, food processors are still seeking to save transaction costs while maintaining the assurance of food quality and safety.

Food processors prefer channel 3 because of the low transaction costs associated with it. The existing direct marketing channel from large organic farms to food processors is similar to channel three. However, does this kind of channel dominate in future China? This question cannot be answered simply by conjoint analysis; it should be discussed in the context of the business and institutional environments in China. If this kind of supply channel is only used for organic foods, then, the popularity of this kind of channel will be restricted by the market demand both at home and overseas. If extended to general foods, then, large farm size is not realistic in the near future, because the small households dominate in the Chinese agri-food system. For practical

consideration, farm size is necessarily small in China even if the existing land tenure system reformed to allow certain land concentration. The small farm size makes it difficult for food processors to trace back and to monitor the contract farmers, which lead to the high monitoring costs. And the test fees per unit of product are also high. That is why currently the large exported-oriented food processors are not willing to deal with small farmers. During the survey, we found that some food processors proposed that their customer farmers must be large enough (at least 2 hectares of land for vegetable production). Clearly, it is difficult to increase farm size significantly in the near future.

In addition to farm size, farm specialization and trust between food processors and vegetable growers are more important factors in channel choices, because the potential hold-up is the major source of transaction costs. The conjoint simulations show that food processors value the trust as the most important attribute with a supply channel. If food processors could trace back and monitor easily their contract farmers, the monitoring costs are low. If there exists the trust between food processors and the vegetable growers, the transaction costs are low. The preference scores are still quite high for the supply channel with high test fees, but with easy traceability and monitoring, as well as with trust, such as channel 2. The conjoint simulations show that the preference scores for channel 2 is 7.3 given by the sample average, and 6.7 given by Longda Group. There is 44.7 percent possibility for food processors to choose channel 2 if based on the BTL rule.

5.5 Summary

This chapter explored how food processors choose their vegetable supply channels in the context of emerging food quality and safety issues based on the conjoint analysis. The hypothesis is that food processors choose among the alternative channels so as to minimize the transaction costs associated with the channels. The conjoint simulations provided us with preference scores for the concerned channels, which are the excellent proxies of preferences. The indirect approach was used to order the relative level of the transaction costs with alternative channels. The study confirmed that food processors shift their supply channels to save transaction costs while maintaining food quality and safety. The most important attribute with supply channel is the trust between the trading parties. The second important attribute is traceability, which is particularly important for exported-oriented food processors. Although farm size is an influential factor for testing fees and traceability, farm specialization and trust are more critical.

6. Policy Implications and Conclusions

6.1 Introduction

Chapter 3 has described the context in which the changing vertical coordination in the Chinese agri-food system occurred. The major driving forces are the increasing agricultural transformation, institutional transition, and trade liberalization. Chapter 4 and Chapter 5 have revealed the major determinants of the changing vertical coordination by case study of Chinese horticultural sector. It is the dynamic institutional and business environment that triggered the relative changes in transaction costs with alternative marketing channels, and then induced farmers and food processors to shift away from open spot market toward contractual arrangements. This chapter discusses the possible implications of this kind of institutional and organizational changes for the transition economy and the stakeholders:

Firstly, the high transaction costs with transition economies are caused mainly by the missing market institutions and infrastructure. This should be addressed by further market-oriented reforms to provide better institutional and business environment, because the economies of specialization and then greater productivity can be only achieved in the economy with low transaction costs.

Secondly, contractual arrangements are widely used in agri-food systems, however, this kind of coordination mechanisms is always afflicted with hold-up and bargaining power issues, which threat the stability of transactional relations between small farmers and food processors. More organizational innovations are needed to address these issues, particularly in the condition of small family farm system.

Thirdly, food quality and safety issues become the significant sources of transaction costs in the Chinese agri-food system. Public and private actions should address food quality and safety issues at lower transaction costs.

Section 2 discusses the importance of further market-oriented reforms to reduce transaction costs in the agri-food systems. Section 3 explores the organizational innovations for the small family farms. Section 4 compares the public and private actions in dealing with food quality and safety issues. Section 5 summarizes the main findings of this study.

6.2 Further Reforms to Improve Market Capabilities

The Chinese agri-food system, one of the largest agri-food systems in the world, has been undergoing historical transformation from traditional semi-subsistence system to modern commercialized production system. The most important features of this transformation include agricultural commercialization, farm specialization and significant technological changes. Along with this transformation, the economies of scale and specialization become increasingly dominant, while the operation of agri-food system is increasingly dependent on transactions. The Stigler model indicated the importance of the extent of market to exploit the economies of scale and specialization, but the model neglected the existence of transaction costs. The transaction cost approach correctly indicated that the process of specialization would be limited by transaction costs (Williamson 1975). There exists a trade-off between the economies of specialization and transaction costs (Yang and Ng 1993). The less transaction costs, the more specialization, and then the higher productivity (Coase 1998).

The major sources of transaction costs with the transition economies come from the missing market institutions and infrastructure, such as, poorly defined property rights, less enforceable commercial laws, imperfect price discovery mechanism, lack of trust between trading parties, and backward informational and logistics system. The transaction costs with horticultural sector is higher than other agri-food sectors because of the high perishability, the importance of quality control and the significant site-specificity. On the other hand, horticulture was liberalized earlier than other agri-food sectors in China, and has been totally commercialized. The response of higher transaction costs with horticultural sector is that contractual arrangements has been emerged earlier and more extensively in this sector.

In order to promote the transformation of Chinese agriculture, it is necessary to improve the capabilities of the market and to lower the transaction costs with the operation of agri-food system. This can be achieved only through further market-oriented reforms.

6.2.1 Market Competition

The increased vertical coordination in agri-food systems raised significant concerns about competition and welfare implications for the stakeholders. The closer vertical coordination has been due to the market failures or imperfect markets. However, the major sources of market problems were different. In advanced market economies, recent market imperfections in agri-food industries resulted mainly from concentration and consolidation, which induced vertical coordination, and in turn, further enhanced concentration and consolidation (Boehlje 1999; Cotterill 2001). In transition economies, the market failures were not from concentration, but from missing market

institutions and infrastructure, such as imperfect price discovery mechanism, lack of enforceable legal environment, missing land and farm service markets, among others.

Different from the neoclassical approach, which focused on market concentration and market power, the transaction cost approach suggested that the changing vertical coordination may reflect the institutional response to the market failures. The markets and the firm are alternative instruments for transactions. The choice depends on the relative efficiency of each mode. The major determinants of the relative efficiency include market uncertainty, human bounded rationality and opportunism. And the boundaries between the market and the firm are always changing, depending on the changes in institutional and business environment. If market failures are serious, more transactions will be internalized within the firm. Otherwise, open spot market is preferred. The internalization could save transaction costs, but it incurs more management costs. Lower transaction costs with the economy are always preferred, because the lower transaction costs, the more specialization, and then the greater productivity (Coase 1998).

Transaction costs with the economy can be lowered by improved market capabilities and better price discovery function. To improve the price discovery function, sufficient market competition is a necessary condition. Market competition is imperfect in the Chinese agri-food system. Before the transition, the Chinese agri-food system was coordinated by the administration similar to vertically integrated structures. However, these vertically integrated structures were actually controlled by different administrative departments or different interests groups, and the transfer prices along agri-food supply chains were heavily distorted. This legacy of the command economy

still played a significant role during the transition period, which not only sacrificed farmers' interests, but also hindered the formation of integrated agri-food market. Until recently, the linkages between farm and off-farm business have not been governed completely by market mechanism. This is partly because of the gradualist approach to market economy adopted, leading to the different degrees of market liberalization among various agri-food industries, and partly because of the existing macro-administration system, which separated the linkages between farm input industries, farm production, and agricultural marketing and distribution industries.

The separation of successive stages along food supply chains as well as the disintegration of market between regions distorted prices and raised transaction costs. This has been shown in case of grains (Park et al. 2002). This issue can be solved by further market-oriented reforms. Market integration and sufficient competition can effectively eliminate price distortion. In contrast, closer vertical coordination can solve this issue only at much higher expense—higher management costs. And the past experience also showed that closer vertical coordination is not an effective means to correct the distorted prices and income distribution. By the end of 1970s, China did experiment the agribusiness model from Eastern European countries (agro-industrial complex, APK in Russian) within the state farms, but the experiment failed due to the fierce interests conflict between different administrative departments.

6.2.2 Land Tenure Institution

Since the introduction of the household responsibility system by the end of 1970s, about 200 millions of rural households have become family farms in China. However, the operational scale of these family farms is very small, only 0.5 hectare of arable land

on average. As a result, transaction costs with these small farmers are quite high in terms of unit product. The small operational scale necessarily go along with low specialization of farm and part-time farming. Our survey also showed that the specialized farms have much larger scales than other farms (see Table 4.1 and Figure 4.2). However, land market is missing in China, and transfer of farmland is strictly restricted, which led to farm operational scale fixed at very small size.

During agricultural transformation, agriculture and the related agri-food industries become increasing commercialized, the economies of scale and specialization become increasingly dominant. But the high transaction costs with the small family farm system hinder the exploitation of the economies of scale and specialization. The increase in farm size is necessary to lower transaction costs. As the rest of national economy can absorb more and more surplus rural labours, land market becomes necessary, which can promote not only land concentration but also labor migration outside of rural country.

6.2.3 Farm Service Market

Seeking farm services from food processors is an important reason for small farmers to choose closer vertical coordination, and sell their products through direct marketing channel. The most important farm services include technical, financial and information services. The technical service was provided by the administrative agencies before the transition. This technical service networks collapsed when market-oriented reforms began in China because of limited financial support and inefficient operations. Then, commercialized technical service was encouraged. However, farm technical service is characterized with the nature of public goods to some extent. Therefore, the viability becomes a challenging issue. Rural financial market was always missing in China, even

before the transition. Small farmers actually cannot get access to financial service. This issue became increasingly serious with agricultural commercialization and farm specialization. Then, small farmers turn to food processors to get some farm inputs without paying immediately. The price discovery mechanism has not well established for agri-food products. Hence, it is very difficult for small farmers to get market information for their business decisions. Missing farm service market definitely increased transaction costs.

6.3 Institutional Innovation for Small Family Farms

Contractual arrangements are the dominant coordination mechanisms currently in the Chinese agri-food system (Wan 2000). However, this kind of coordination mechanisms is always afflicted with the issues of hold-up and bargaining power. Hold-up refers to the behaviours of explicitly or implicitly breaching the contract. When the market price is higher than the contracting price, farmers may simply break the contract, and sell their products to the market. In contrary, when the market price is lower than the contracting prices, food processors may delay the payment or change their standard. Bargaining power is reflected by the contracting party's ability to influence the contracting price and other terms of the contract. Only balanced bargaining power can lead to the sharing risk and rewards between the contracting parties.

During the period of the transition, market uncertainty is very high, commercial laws are less enforceable. In fact, court enforcement is prohibitively expensive and even impossible in China because of too many and too small farmers, which in turn, triggered more hold-up behaviours and even higher uncertainty of market. On the other hand, Chinese farmers are less organized; therefore, their bargaining power is very

weak. The contracting prices are almost unilaterally determined by food processors. The issues of hold-up and bargaining power threaten the stable relations between small farmers and relatively large food processors, and may affect the rural development. Therefore, further institutional innovation is necessary especially in the condition of the small family farm system.

6.3.1 Private Enforcement

(Klein 1996) claimed that private enforcement could be effective when the specific investments and reputation effects with the trading parties are significant. The trading party who breach the contract will face private sanction in terms of the capital loss associated with his specific investments and reputation damage. He will balance the potential hold-up gain from breaching the contract and the potential capital loss from the private sanction. If the gain is less than the loss, they will probably keep promise, and the contract becomes self-enforcing. On contrary, if the gain is more than the loss, he may choose to breach the contract.

The extent to which market conditions can change without precipitating a hold-up by either party is called the self-enforcing range of a contractual relationship. This range is determined by asset specificity, reputation effect, and public sanction. The case studies proved that the self-enforcing range can be shifted and changed through the contract innovations. Food processors may successfully improve their reputations and effectively secure the stable supply from their contract farmers through introducing input provision and investment facilitation programs (Gow and Swinnen 1998; Gow et al. 2000). If both contracting parties invest more specific investments symmetrically and transact more frequently, their relationships could be more stable.

However, private enforcement cannot be independent of court enforcement that provides the benchmark for the definition of the self-enforcing range. This implies that even if private enforcement can play some roles under certain conditions, court enforcement is still necessary. The establishment of legal enforceable institutions are necessary conditions to save transaction costs. As the World Development Report claimed that good laws and their effective enforcement can create the incentives for efficiency, increase the commercial certainty, and lower the transaction costs (World Bank 1996).

6.3.2 Internalization Strategy

Vertical coordination mechanisms can be ranked as a spectrum ranging from open spot market to vertical integration. Along this spectrum, the economic organization of coordination becomes increasingly firm-like. The transaction costs with the organization decline, while the management costs with the organization increases. The economic agents have to make a trade-off between the transaction costs and the management costs. The principle for this choice is that "a firm will tend to expand until the costs of organizing an extra transaction within the firm become equal to the costs of carrying out the same transaction by means of an exchange on the open market or the costs of organizing it in another firm"(Coase 1937).

The hold-up and bargaining power issues with contractual arrangements can be solved by internalization of transactions. The practices tried in transition economies include: (1) farmers extended their activities into food processing stages by setting up their own processing facilities; (2) food processors extend their activities backward into agricultural production by renting farmers' land and operating as commercial farms; (3)

farmers establish marketing cooperatives as instruments to enhance collective bargaining power; (4) farmers are absorbed as shareholders of food processing companies.

1. Forward Integration

Farmers extend their operations into food processing stage. Forward integration could avoid hold-up and bargaining power issues, create employment opportunities, and improve farmer's income position. This forward integration could be attractive if the country has evolved into the second stage of agricultural transformation, during which production factors and resources flow out of farm sector, leading to the decline of farm employment and agriculture's share in the national economy. In China, the rural employment and farm incomes have become increasingly serious issues since the mid-1980s. The annual growth rate of farm income per capita has decreased for four consecutive years since 1997. The stagnant farm income growth has consequently affected national economic growth (Liang 2002). In this context, farmers extending the value-added chains are greatly encouraged.

But this strategy also has its disadvantages. Firstly, extending the operational activities into the unfamiliar area may lead to the decline in the competitive advantage of the firm, because spreading the current capabilities over more dissimilar activities or acquiring the related complementary capabilities through mergers and acquisitions could be limited by the imperfect information and cognitive limitation of the firm, leading to higher production costs, higher governance costs, and diminishing returns. Therefore, the firm should not adopt this internalization strategy unless there exist prohibitive transaction costs impeding contractual arrangements (Richardson 1972).

Secondly, it may end up with low capacity utilization of both newly and early established food processing facilities. This was proved by the case of Russia. In 1995, a quarter of large farms in Russia established their own processing facilities, but the capacity utilization of two-thirds of newly established processing facilities was under 50 percent. The expansion of food processing industry caused lower capacity utilization of the early established processing firms (Yakunina et al. 1998).

2. Backward integration

Food processors extend their operations into farm production. Food processors may operate commercial farms by renting farmers' land and then hiring farmers as wage earners. In this case, they have to confront with the principal-agent problems, the difficult issues of supervision, monitoring, and measurement, which exist in team production. The successful experience of rural reforms in China is to avoid the principal-agent problems by making farmers as the residual claimants, that is, replacing collective farming by family farms, which stimulated farmers' incentives to work and then improved agricultural productivity. The integrators operating commercial farms will meet the same problems with the collective farming, which has been proved to be costly.

6.3.3 Marketing Cooperatives

Marketing cooperatives could enhance farmers' bargaining power, facilitate farmers' access to farm services, stabilize contractual relationships, and save transaction costs (Cook 1995; Deininger 1995; Holloway et al. 2000). This kind of coordination mechanism has been encouraged in transition economies. But in China, they accounted for only about 9 percent among all of vertical coordination mechanisms. Thus, some

researchers suggested that the government should promote marketing cooperatives as the major form of vertical coordination mechanisms in agri-food system (Niu 1997b).

However, marketing cooperatives have their own disadvantages, such as less incentive and limited capital access. An important factor in China is the path dependent effect of the historical failure in collective farming system on Chinese farmers' willingness to commit to such kind of organizations. On the other hand, the government worries about that the organization may evolve into interests group. Until recently, Chinese government has not formulated any regulation to promote the development of cooperatives (Han 2000). In practice, marketing cooperatives in China are at their very early stages with vey little investments (Zhou and Cao 2001). We can expect little role from Chinese agricultural cooperatives in the near future.

6.4 Public and Private Actions for Food Quality and Safety

The recently emerged food quality and safety issues are the important sources of transaction costs in the Chinese agri-food system. Food processors imposed the food quality inspection, which induced farmers to shift their marketing channel to avoid the refusal of their products. At the same time, food processors also incurred much more transaction costs in inspecting, monitoring and tracing back the contracting farmers. This kind of transaction costs mainly arises from the principal-agent issues--asymmetric information, asymmetric incentives and measurement difficulties. Saving transaction costs while still maintaining food quality and safety becomes a challenging task, particularly in the condition of the small family farm system. Both private and public actions are needed.

6.4.1 Private Actions

There is a variety of strategies to deal with the food quality and safety issues, such as, closer vertical coordination, third-party verification, and branding and reputation strategy (Sporleder and Goldsmith 2001). Vertical integration has been proved effective in reducing pesticide residues in horticultural products (Kilmer et al. 2001). But it is not possible to adopt this strategy to control the whole process of food production from farm to table, because the management costs with this strategy is usually too high, and then very few successful cases existed in the history. An alternative mechanism is strategic alliances or cooperative arrangements along food supply chains, usually called food supply chain management. Supply chain management emphasizes information flows and cooperation between upstream and downstream firms, but it is still mainly based on market transactions. Hence, this strategy can effectively save transaction costs as well as bureaucratic costs along food supply chains. When agribusiness firms adopt the differentiation strategy through branding and reputation to signal the product quality to the consumers, they usually have to implement food supply chain management to enhance the credibility of their branded names.

6.4.2 Public Actions

Only very few multinationals have the capabilities to develop their own private grades and standards. Agribusiness firms usually have to adopt the public grades and standards. In China, farmers and food processors are very small, the differentiation strategy through branding and reputation is usually not feasible for them. Therefore, third party verification and public regulations on grades and standards become very important for these small agribusiness firms to deal with food quality and safety

economically. To implement public grades and standards system, government certification and testing centres are necessary institutions and infrastructure.

In addition, informational labelling can also reduce measurement costs and lower transaction costs with the contracting parties. According to (Caswell and Mojduszka 1996), food safety and nutrition are largely credence attributes where the consumer has significant difficulty or cannot assess quality even after consumption. As a result, the informed consumer and reputation models do not apply to food safety and nutrition. Quality signalling may be still used, but a reputable certification agent is required. The government is such an agent who can make it practicable for consumers to assess food quality by requiring informational labelling. The mandatory label that discloses the information about the nature of product and process of production can transform credence attributes into search attributes where consumers can determine the quality of this product before they buy it by examining or researching the product. Pesticide residue in vegetables is a credence attribute. Unless mandatory informational label is provided, vegetable consumers cannot make judgement about the quality of vegetables.

6.5 Principal Findings and Conclusions of the Study

There has been closer vertical coordination in agri-food system not only in advanced market economies but also in transition economies. However, the changing vertical coordination has occurred in different contexts. In advanced market economies, agricultural transformation is finished; agri-food systems operate in relatively perfect market conditions and perfect legal enforceable environment. Market concentration and consolidation are the outstanding issues of market imperfection in these countries. In developing and transition economies, agricultural transformation is not finished yet;

agri-food systems operate in highly imperfect market conditions and poorly legal enforceable environment. The missing market institutions and infrastructure are the major sources of market imperfections in developing and transition economies. The different contexts suggest that the major driving forces, the dominant determinants, and particularly, the implications of recently changing vertical coordination in agri-food systems could be significantly different.

This study has examined the driving forces, determinants and implications of increasing contractual arrangements in the Chinese agri-food system based on the transaction cost approach by case study of the horticultural sector in Laiyang city of Shandong province, a typical horticultural producing and exporting region in China. The survey data have been obtained from personal interviews with the vegetable growers and food processors in Laiyang city with structured questionnaire. The logistic regressions and conjoint analysis have been conducted to identify the dominant influencing factors in marketing and supply channel choice decisions by vegetable growers and food processors. Policy implications for the transition economies and further organizational innovations particularly in the condition of small family farms have been discussed. The major conclusions of this study are summarized as follows:

1. The Major Driving Forces

Many studies argued that market concentration and consolidation are the major drivers of recently closer vertical coordination, which in turn, has further enhanced market concentration in advanced market economies. But the situation in developing and transition economies is quite different. China is the largest developing and transition economy in the world. In China, market concentration is very low, and technological

change is not significant at current stage. However, the vertical coordination in the Chinese agri-food system also tends to be closer. The typical evidence is the increasing contractual arrangements have emerged especially in the horticultural and livestock sectors since the mid 1990s. This study reveals that the major driving forces of closer vertical coordination come from increasing agricultural transformation, which is accompanied by the institutional transition and trade liberalization.

Chinese agriculture has been undergoing historical transformation from a traditional semi-subsistence system to a modern commercialized production system. This transformation is characterized with agricultural commercialization and farm specialization. The recent process of agricultural commercialization has been actually triggered by the institutional transition, and further enhanced by trade liberalization and recent accession to the WTO. Along with this transformation, the economies of scale and specialization become increasingly significant. The operation of the Chinese agri-food system increasingly depends on markets both domestically and world widely as Chinese agriculture is integrated with rest of national economy and world food market.

On the other hand, the market capabilities and transaction efficiencies with the Chinese agri-food system is relatively low. China is a transition economy where missing market institutions and infrastructure are quite common, commercial contracts are difficult to be enforced, and property rights are poorly defined. Secondly, the operational scale of family farms in China is among the smallest in the world. Thirdly, the transaction costs with horticultural products are particularly higher because of the perishability and location specific nature. Consequently, the transaction costs with the Chinese agri-food system are quite high.

The economies of scale and specialization are therefore limited by the high transaction costs with the Chinese agri-food system. The trade-off between the economies of specialization and transaction costs is the basic reference of organizational innovations by the economic agents.

2. The Dominant Determinants

The results of logistic regression analysis demonstrated that the critical determinant of farmers' marketing channel choice is the combination of farm specialization and the imposition of food quality and safety inspection by food processors. Farm specialization could be perceived as a kind of specific investments, which increases the specialized farms' risks and dependence on their buyers. The simulations have shown that seeking farm services and avoiding price risks are the major motivations for specialized farmers to sell their vegetables directly to food processors rather than via middlemen or via wholesale markets. But the trade-offs exist due to the declining bargaining power by farmers against food processors along with increasing direct marketing to food processors.

The conjoint analysis has further confirmed that the trading party's creditability and the traceability of food quality and safety along food supply chains are the fundamental sources of transaction costs, which prevent food processors from using open spot market and wholesale market. The conjoint simulations have shown that open spot market will be rarely used under the circumstance of increasing concerns from consumers about food quality and safety. In contrast, the large commercial farms, which adopt direct marketing to food processors, are highly preferred by food processors, because this kind of supply channel could save transaction costs and could

assure the food quality and safety of their final products. This is the essential source of the firms' competitive advantage.

The above quantitative study has shown that increasing agricultural transformation, institutional transition, and trade liberalization in China have caused the relative changes in transaction costs with alternative marketing channels, leaving open spot market as a much more expensive option than other alternative channels. As a result, the participants of agri-food supply chains are motivated to shift their marketing channels in order to reduce transaction costs.

3. The Policy Implications

The implications of increasing contractual arrangements in agri-food systems in developing and transition economies are profound. The trend could have significant potential impacts on further market-oriented reforms in transition economies. It could affect farmers' bargaining powers and then income distribution between small farmers and food processors, which to a large extent, depending on the market structures and organization of agri-food systems. This organizational innovation is challenging the existing land tenure system. More and more food processors are shifting their trading partners from small farmers to large commercial farmers. Consequently, small farmers may be marginalized. The food quality and safety issues further complicated vertical coordination and deeply affect the organization of the Chinese agri-food system.

This study suggests that in order to promote agricultural transformation in transition economies, high transaction costs with agri-food systems must be reduced, because the economies of scale and specialization and greater productivity can be only achieved in

the economy with lower transaction costs.

Firstly, the missing market institutions and infrastructure should be addressed by further market-oriented reforms to provide better institutional and business environment. In China, the separation of linkages between farm and off-farm, between agriculture and the rest of the national economy should be solved by market integration and effective market competition to eliminate the price distortions formed in the history, and should not attempt to accomplish this task through the internalization strategy or any closer vertical coordination, because closer vertical coordination means higher management costs, and less economies of scale and specialization. The missing land market, rural financial market, and other farm service markets should be established in the near future to improve the market capabilities and transaction efficiencies.

Secondly, the internalization strategy is not realistic for the Chinese agri-food system. Further institutional innovations should be conditioned under the small family farm system, because even the transformation of Chinese agriculture enters into the advanced stage, the situation of small operational scale cannot be greatly changed taking into consideration of large population and limited arable land in China. The contract innovation, accompanied by the complementary public regulations, could be correct direction for vertical organization of the Chinese agri-food system in order to avoid hold-up and unbalanced bargaining power issues.

Thirdly, both public and private actions should be taken to assure food quality and safety as well as to reduce the transaction costs with these issues. The very large agribusiness firms may adopt the differentiation strategy through branding and

reputation, which usually triggers closer vertical coordination. Considering the fact that small farmers and small food processors are dominant currently in China, more public actions and third party certifications may be necessary, including using informational labelling, because the attributes of food safety and nutrition are credence in nature.

6.6 Limitations of This Study and Future Research Directions

While there have been increasing number of studies on agroindustrialization, few of them have quantitatively analyzed the determinants of changing vertical coordination in the agri-food systems in developing and transition economies. This study adopted the transaction cost approach and empirically investigated the driving forces, determinants and implications of changing vertical coordination in the Chinese agri-food system. It demonstrated that the transaction cost approach is a useful instrument to investigate such kind of issues. The study may contribute to the current policy debate in China and also constructive to the empirical study of the transaction cost approach.

It should be pointed out that, however, there were several limitations with this study. Firstly, the measurement of transaction costs in this study was indirect and indicative only. It is well known that the concept of transaction costs is abstract and difficult to measure. There is little useful published data available to calculate such kind of costs. Researchers who adopt the transaction cost approach have to collect relevant data usually by surveys. Survey data are valuable but expensive. As a result, sizes of samples are often small, which may arise some methodological issues, such as collinearity between explanatory variables, and may affect the conclusions.

Secondly, several non-scale explanatory variables in this study were measured in

ordinal forms. Transformation of these variables into dummy variables may produce too many explanatory variables to establish meaningful econometric models, based only on this small sample survey data. Transformation may also result in collinearity issue and then restrict econometric model analysis. This study followed the way by Boger (2001), who measured non-scale variables in ordinal forms and argued that the transformation into dummy variables did not improve model estimation significantly. We argued that the purpose of this study was only to test the significance of transaction costs-based factors in farmers' marketing channel choice decision, it was not our objective to predict accurately the causal relationships between marketing channel choice and these explanatory variables. Even measured in ordinal forms, these non-scale variables may not affect the signs (negative, positive or insignificant) of coefficients in regression models.

Thirdly, the survey sample was selected from Shandong Province, where commercial and export-oriented agriculture has been relatively advanced in China, especially in the vegetable industry. Comparing with the rest of the country, agricultural transformation in this region advances more fast, and regional and farm specialization has become an increasingly important phenomenon. However, the trend of development is the same for the whole country. It is reasonable to believe that the issues and subsequent institutional changes may occur in other regions in the near future. The differences between industries may be greater than between regions. Within the agri-food system, horticultural and livestock industries are more sensitive to the transaction cost issues because of perishability and more difficulties in measurement of quality and safety than other agri-food products, such as grains and edible oils. Therefore, policy implications

for different industries may be different although there are certainly some similarities.

Further studies are needed to find out the regularities of vertical organization in agri-food systems in developing and transition countries. Especially interesting topics include how to save transaction costs in agri-food systems under the condition of very small family farm system? What are the relationships between vertical organization of agri-food system, transaction costs and international competitiveness of agri-food industries under the situation of emerging food quality and safety issues? What are the government's roles to innovate organization of agricultural and food industrial industry in the context of increasing agricultural transformation in developing and transition economies through institutional innovation?

APPENDIX A: VARIABLE DESCRIPTION FOR HOUSEHOLD SURVEY

Variables	Description and values	Measurement
Marketing channel	0= via middlemen or wholesale market 1= direct sale to food processor	Nominal
Contract type	0=no contract 1=contract (oral or written)	Ordinal
Farm specialization	Percentage of household income from vegetable production (%)	Scale
Specific investment	1=very little 2=little 3=moderate 4=heavy 5=very heavy	Ordinal
Quality inspection	0=no test 1=pesticide residue test	Nominal
Farm services	1=very little 2=little 3=moderate 4=much 5=very much	Ordinal
Price fluctuation	1=less than 10% 2=10-30% 3=more than 30%	Ordinal
Information access	1=very difficult 2=difficult 3=middle 4=easy 5=very easy	Ordinal
Bargaining power	1=passively accepting price 2=little bargaining power 3=moderate bargaining power 4=nearly equal bargaining power 5=equally negotiating the price	Ordinal
Payment delay	Cash payment delay(months)	Scale
Cultivation area	Vegetable planting area (mu)	Scale
Cropping intensity	1=open field 2=plastic film 3=green house	Ordinal
Transport costs	Farmer's transport costs(¥/mu)	Scale

APPENDIX B: QUESTIONNAIRE FOR FOOD PROCESSOR SURVEY

Case	Test Fees	Traceability	Trust	Monitor	Please Rank: 1---the most prefered 10---the least prefered									
1	Low	Difficult	Good	Easy	1	2	3	4	5	6	7	8	9	10
2	High	Easy	Bad	Easy	1	2	3	4	5	6	7	8	9	10
3	High	Difficult	Good	Difficult	1	2	3	4	5	6	7	8	9	10
4	Low	Easy	Good	Difficult	1	2	3	4	5	6	7	8	9	10
5	Low	Easy	Bad	Difficult	1	2	3	4	5	6	7	8	9	10
6	Low	Difficult	Bad	Easy	1	2	3	4	5	6	7	8	9	10
7	High	Difficult	Bad	Difficult	1	2	3	4	5	6	7	8	9	10
8	High	Easy	Good	Easy	1	2	3	4	5	6	7	8	9	10
9	High	Easy	Good	Difficult	1	2	3	4	5	6	7	8	9	10
10	High	Difficult	Good	Easy	1	2	3	4	5	6	7	8	9	10

Notes for the questionnaire: (a) test fees are the fees spent on testing pesticide residue in vegetables per unit of product; (b) traceability refers to the ability for food processors to trace back original producers; (c) trust is mutual creditability between food processors and vegetable growers; (d) monitor refers to the ability for food processors to monitor farmers' activities.

APPENDIX C: SYNTHETIC PRICE MARGINS OF VEGETABLES

	Construction	
	Cost (Yuan)	Volume (kg)
Farmgate Price(¥1.00/kg)	**1000.00**	**1000**
Transport Cost: Farm to Shouguang Wholesale Market (30km @ ¥ 2.00 / t-km)	60.00	
Shouguang Market Costs		
Management fees(1.5%)	15.00	
Taxes (3.5%)	35.00	
Boxes (¥2.00/ box of 25 kg, one time reusable)	40.00	
Other wholesale costs (weighing, etc ¥ 0.10/ kg)	100.00	
Profit (10%)	125.00	
Physical losses (10%)		100
Value and Quantity, ex-Shouguang (¥1.53/ kg)	**1375.00**	**900**
Transport to Beijing (Dazhongsi Wholesale Market) (¥0.30/ kg x900 kg)	270.00	
Dazhongsi Market costs		
Management fees(2.0%)	27.50	
Taxes (5-7%)	68.75	
Other wholesale costs (weighing, etc ¥0.10/ kg)	90.00	
Profit (10%)	183.13	
Physical losses(10%)		90
Value and Quantity, ex Dazhongsi (¥2.49/ kg)	**2014.38**	**810**
Retailer Cost		
Exit fee from wholesale market 92%)	40.29	
Stall rental (¥5.00/day assume 100 kg/stall/day)	40.50	
Transport and other selling costs (¥0.02/ kg)	16.20	
Profit (20%)	422.27	
Physical losses (12-15%)		110
Value and Quantity of Retail Sales to Consumers	**2533.64**	**700**
Consumer Price (¥ 3.62 /kg)		

Source: World Bank 1996

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