MEASURING THE IMPACT OF INTEGRATION AND DIVERSIFICATION ON FIRM VALUE IN THE FOOD INDUSTRY

by

SARAH GAYLE DORSEY

B.S., Oklahoma State University, 2001
M.S., Kansas State University, 2002

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2006

Abstract

The strategic decision a firm makes in determining where to set its vertical and horizontal boundaries is a widely discussed topic in the literature. This strategic decision can include vertical integration, horizontal integration and diversification outside of the food economy. These activities can impact a firm in different ways.

The objective of this research is to determine whether food economy firms pursuing diversification or integration are valued lower or higher as a whole than the sum of their individual segments. This is commonly referred to as a premium or discount. The hypothesis is that a premium exists for food economy firms that pursue integration activities and a discount exists for food economy firms that pursue diversification activities. Four separate food economy sectors are used in the analysis: food processing, wholesale grocery, retail supermarkets, and restaurants.

To determine whether a premium or discount exists for integration or diversification, an excess value calculation method is used which compares the actual value of a firm to the imputed value of all of the segments of a firm. This excess value is then used in a seemingly unrelated regression (SUR) framework to determine how certain firm characteristics influence firm value. But, these firm effects may both lead a firm to diversify or integrate and affect firm value. This would incorrectly attribute a premium or discount to the diversification or integration itself and not the underlying firm characteristics that caused the firm to pursue such a strategy. To account for these underlying firm and industry characteristics, Heckman's two-stage procedure is used to control for the self-selection of firms that diversify.

The SUR results indicate that the hypothesis that integration leads to a premium for food economy firms cannot be rejected for the restaurant sector and for the processing sector except in the case of vertical integration into retail. The endogeneity tests indicate that, in most cases, the diversification or integration decisions are endogenous meaning that the firm effects that cause firms to diversify or integrate are positively or negatively correlated with firm value. In the cases of vertical integration into wholesale in the processing and restaurant sectors and unrelated diversification in the restaurant sector, including a self selection parameter makes the premiums found using SUR become discounts.

MEASURING THE IMPACT OF INTEGRATION AND DIVERSIFICATION ON FIRM VALUE IN THE FOOD INDUSTRY

by

SARAH GAYLE DORSEY

B.S., Oklahoma State University, 2001
M.S., Kansas State University, 2002

A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2006

Approved by:

Major Professor
Dr. Michael Boland

Abstract

The strategic decision a firm makes in determining where to set its vertical and horizontal boundaries is a widely discussed topic in the literature. This strategic decision can include vertical integration, horizontal integration and diversification outside of the food economy. These activities can impact a firm in different ways.

The objective of this research is to determine whether food economy firms pursuing diversification or integration are valued lower or higher as a whole than the sum of their individual segments. This is commonly referred to as a premium or discount. The hypothesis is that a premium exists for food economy firms that pursue integration activities and a discount exists for food economy firms that pursue diversification activities. Four separate food economy sectors are used in the analysis: food processing, wholesale grocery, retail supermarkets, and restaurants.

To determine whether a premium or discount exists for integration or diversification, an excess value calculation method is used which compares the actual value of a firm to the imputed value of all of the segments of a firm. This excess value is then used in a seemingly unrelated regression (SUR) framework to determine how certain firm characteristics influence firm value. But, these firm effects may both lead a firm to diversify or integrate and affect firm value. This would incorrectly attribute a premium or discount to the diversification or integration itself and not the underlying firm characteristics that caused the firm to pursue such a strategy. To account for these underlying firm and industry characteristics, Heckman's two-stage procedure is used to control for the self-selection of firms that diversify.

The SUR results indicate that the hypothesis that integration leads to a premium for food economy firms cannot be rejected for the restaurant sector and for the processing sector except in the case of vertical integration into retail. The endogeneity tests indicate that, in most cases, the diversification or integration decisions are endogenous meaning that the firm effects that cause firms to diversify or integrate are positively or negatively correlated with firm value. In the cases of vertical integration into wholesale in the processing and restaurant sectors and unrelated diversification in the restaurant sector, including a self selection parameter makes the premiums found using SUR become discounts.

Table of Contents

List of Figures

List of Tables

Acknowledgements

To Dr. Michael Boland, throughout my time at Kansas State University you have been a wonderful advisor and mentor. You are such an inspiration because of your genuine caring and concern for the well-being and success of your students. I cannot thank you enough for your constant support and encouragement.

To Dr. John Crespi, I am so thankful that you were on my committee. Your perspective and your advice have meant so much to me throughout my time at K-State. You have a way of pushing people to be better than they think they can be while maintaining a kind and thoughtful manner. Thank you for pushing me.

To Drs. Allen Featherstone and Eric Higgins, your expertise was invaluable to me during this process and I thank you for your time and effort.

To all the graduate students, faculty and staff at Kansas State University, you have made being away from home bearable. I appreciate your constant support, encouragement and friendship.

To my family and friends, I love you all and I could not have made it through my graduate work without you. You all are my joy and my strength.

To my beautiful husband, Dustin, how can I even begin to express what you mean to me? I love you so much. I survived the struggles I have encountered during the Ph.D. program because you are in my life and waiting for me at the end of this journey.

To my Savior, Jesus Christ, through you all things are possible.

Dedication

To my family

CHAPTER 1 - Introduction

The strategic decision a firm makes in determining where to set its vertical and horizontal boundaries is a widely discussed topic in the agricultural economics literature, as well as in business literature in general. When economists discuss these strategic decisions, they use terms such as vertical integration and horizontal integration. Vertical integration is defined as a method of vertical marketing system synchronization in which coordination of two or more stages occur under common ownership via management directive (Martinez 1999). Horizontal integration is similar to vertical integration except horizontal integration refers to firms pursuing activities that are in the same stage in the marketing system. Figure 1.1 provides an example of these integration concepts.

It is important to note that vertical integration is a type of vertical coordination but sometimes these terms are used interchangeably in the economics literature. In this thesis, vertical integration refers to situations in which all coordination activities are owned by a single firm. There are many types of vertical coordination, including contracting and strategic alliances. And, while these types of coordination are important in agricultural markets, they are beyond the scope of this study. Firms pursue strategies to expand or contract their vertical and horizontal boundaries for several reasons, including taking advantage of economies of scope and scale and differentiating themselves from competitors.

A related topic in the literature is diversification, a common topic in the business and finance literature. According to this literature, diversification is referred to as related or unrelated, meaning that firms can pursue activities that are related to their core businesses and activities that are not related to their core businesses. The distinction is made because the activities can impact a firm in different ways. For the purposes of this study, diversification refers to activities outside of the food economy. This is done to distinguish diversification from vertical or horizontal integration, which are forms of related diversification.

Unrelated diversification and integration strategies are pursued by firms for financial and strategic reasons. One of the main financial motivations is reducing risk. Much like an individual would reduce risk in their personal investment portfolio, some firms may choose to purchase businesses with different market characteristics from their core businesses in order to spread risk exposure. This is commonly referred to as unrelated diversification and for the purposes of this paper is referred to simply as diversification.

A strategic reason for integration is to exploit economies of scope. Economies of scope exist when a firm achieves savings as it increases the variety of goods or services it produces (Besanko, Dranove, and Shanley 2000). Some firms find they have resources available that they cannot utilize in their current operations. These include managerial as well as physical resources. Sometimes it is possible to increase the size of the firm's current operations to take advantage of these resources but other times this may not be possible due to competitive conditions in the market. In this case, a firm could choose to integrate into similar markets to utilize current resources, creating economies of scope. For example, if a firm processes and mills wheat, it may be able to use the same production facilities and transportation network to process other commodities.

Many authors suggest that the presence of vertical integration is motivated by transaction costs (Martinez 2002, Hennessy 1996, Frank and Henderson 1992). Martinez (2002) discusses theories originally presented by Williamson (1991) which indicate that asset specificity is the transaction cost associated with spot-market coordination. When the level of asset specificity is very high vertical integration is the method of vertical coordination that minimizes costs.

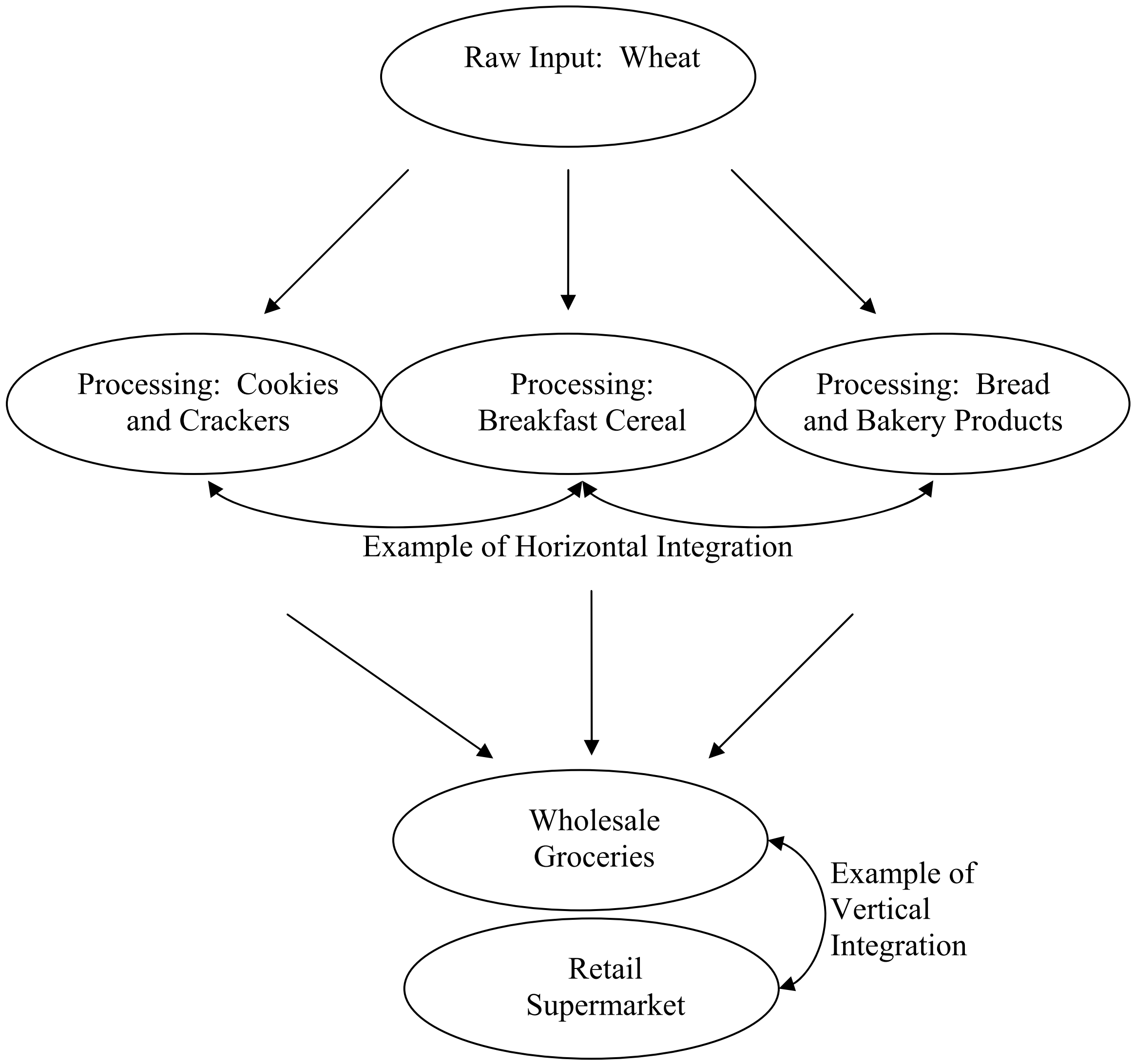

Figure 1.1 Example of the Flow of Goods in the Food Value Chain

1.1 Objective

Because firms diversify and integrate for different reasons, it is not immediately clear how these decisions affect firm value. The research literature is not definitive on whether firms pursuing diversification or integration are valued lower or higher as a whole than the sum of their individual segments would be if they were stand-alone firms. This concept is commonly referred to as a discount or premium.

This study looks specifically at the food economy. The reasons for doing so are discussed in the next section. The hypothesis is that a premium exists for food economy firms that pursue integration activities and a discount exists for food economy firms that pursue diversification activities. Diversification is thought to be a discount because the literature has generally found a discount from diversification for firms in the US economy (Berger and Ofek 1995, Lang and Stulz 1994, Servaes 1996, Laeven and Levine 2005). It is thought that integration increases firm value because this is the prevailing thought in the agricultural economics literature and integration is prevalent in food economy firms (Barkema, Drabenstott, and Welch 1991, Young and Hobbs 2002).

While many studies have investigated the discount and premium for diversification described above, none have specifically singled out the food economy as a basis for analysis and separated the effects of diversification and integration. Therefore, the objective of this study is to analyze whether a discount or premium exists in four distinct sectors of the food economy as defined by Harris et. al. (2002). These four sectors are:

- Food processing: firms and their establishments that manufacture or process foods and beverages for human consumption and other related products such as manufactured ice, chewing gum, vegetable and animal fats and oils, and prepared feeds for animals and fowls.
- Wholesale grocery: part of the food system in which goods are assembled, stored, and transported to retailers, food service organizations (hotels, restaurants, schools, etc.), other wholesalers, exporters, or other types of businesses.
- Retail supermarket: a retail food store that sells a general line of food products such as canned and frozen foods; fresh fruits and vegetables; fresh and prepared meats, fish

and poultry; and non food grocery products for which the majority of the sales in food products are intended for off-premises preparation and consumption.

- Restaurant: an establishment that dispenses prepared meals and snacks for on-premise or immediate consumption.

Firms are assigned to the above sectors based on four-digit U.S. Department of Commerce Standard Industrial Classification (SIC) codes under which they are required to report financial information. The specific codes and descriptions used in this study are given in Appendix A.

Each of the four sectors described above are analyzed separately in the following chapters because the unique characteristics of the food economy discussed in the next section may influence different sectors in different ways. Also, reasons for diversification and integration may differ among sectors of the food economy.

The food processing sector is the largest of the four sectors. Rogers (2001) studied consolidation in the food processing sector and found that it has steadily increased since 1954. In 1987, the top twenty food processing firms accounted for 36 percent of industry sales. This amount rose to 44 percent in 1992 and then to 51 percent in 1997. Harris et. al. (2002) gives three reasons why food processing firms may be seeking to integrate through mergers and consolidation. First, less efficient plants are closing or merging with efficient plants (U.S. Industry and Trade Outlook 2000). Second, firms can broaden product lines and gain domestic market share through mergers, which is often difficult in mature markets. Third, food processors may use mergers as a defensive strategy to counter the purchasing clout of increasingly concentrated food retailers.

Most of the integration in the restaurant sector is occurring because large restaurant chains are acquiring or developing food processing facilities to manufacture food ingredients and/or prepared foods for sale at their restaurants. This may increase efficiency and help ensure a consistent product.

The wholesale grocery and retail supermarket sectors are examined separately in this research but it is important to note the relationship between these two sectors. Traditional food wholesalers that buy food from manufacturers and then sell to retail food stores are becoming scarce (Kinsey 1999). It is becoming more common for manufacturers to deliver products directly to stores. Self-distributing retailers are also very common, accounting for 47 of the 50 largest food retailers in 1999. These firms own their own distribution centers and buy directly from manufacturers. Along with the trends mentioned above, the supermarket sector is also becoming more concentrated. The largest 4, 8, and 20 food retailers accounted for 28, 41 and 52 percent of U.S. retail grocery stores sales in 2000, a significant increase from 1996 (Harris et. al. 2002).

1.2 Motivation

The food system is a very important part of the U.S. economy. Food and fiber manufacturing and distribution accounted for 7.7 percent of U.S. gross domestic product (GDP) and employed 12 percent of the U.S. labor force in 2000 (Harris et. al. 2002). Also, there are many things that make agricultural and food businesses distinctly different than businesses in other sectors of the economy. According to Kinsey (2001) the food economy is "one of the most dynamic and critical industries in the country and the world." Sonka and Hudson (1989) list five characteristics that make the food economy unique:

- The unique cultural, institutional, and political aspects of food, domestically and internationally.

- The uncertainty arising from the underlying biologic basis of crop and livestock production.
- The alternative goals and forms of political intervention across subsectors and between nations in an increasingly global industry.
- Institutional arrangements that place significant portions of the technology development process in the public sector.
- The differing competitive structures existing within and among the subsectors of the food and agribusiness sector.

Sonka and Hudson (1989) suggest that these characteristics imply special managerial skills and knowledge may be needed to make efficient and effective decisions in agribusiness firms. This special knowledge could include how diversification and integration strategies affect the value of a food business and/or agribusiness firm.

One of the facts that most strongly influences the uniqueness of the food economy is that food is necessary for every person. Also, food and the atmosphere in which it is prepared and consumed is one of the most important parts of human culture. Most food is highly perishable and can harm people if spoiled. Therefore, food and its production are very heavily regulated and supported by most governments. This regulation has increased with the recent increased emphasis on food safety.

Another unique characteristic of the food industry is the distinctive production risks that influence inputs to the food value chain. Most other industries do not have weather, disease and pest issues that influence their input supply. This causes an unusually high level of uncertainty in the food economy. Perishability of agricultural products also presents unique challenges for firms that produce, distribute and sell food.

1.3 Chapter Organization

The following chapter, Chapter 2, discusses several relevant areas of the literature that address diversification and integration and their impact on the firm. Chapter 3 presents a conceptual model to assess the premium or discount associated with integration and diversification strategies and discusses the food economy data and empirical framework used to estimate the conceptual model. In Chapter 4, the results of the analysis are presented and discussed. Finally, conclusions, limitations, and suggestions for future research are presented in Chapter 5.

CHAPTER 2 - Literature Review

Many articles have been written discussing the decision to integrate or diversify and the impacts of these decisions on the firm. The following sections discuss and summarize various topics related to vertical and horizontal integration, diversification and firm valuation found in the current literature.

2.1 Vertical and Horizontal Integration

Integration is a widely discussed topic in the economics literature. The first section below covers several articles that discuss and develop the theory of integration in economics. This is followed by a discussion of some research related to integration in the food economy. Most of this research is theoretical as well although there are a few empirical studies.

2.1.1 Integration Theory

Vertical and horizontal integration are important topics in agricultural economics literature and are becoming more so as these and other types of market coordination strategies become more prevalent. According to Barry, Sonka, and Lajili (1992), "the manager's task now involves selecting the boundaries of the firm (defined by contractual and asset control relationships) along with the more traditional tasks of choosing the firm's size, enterprises, and financing."

An influential paper by Coase (1937) was among the first to discuss integration and its relationship to the definition of a firm, indicating the "supersession of the price mechanism" through vertical integration is a defining characteristic of a firm. Firms can get the inputs they need from other firms, through a contractual arrangement or they can make them within their own firm. But, as Coase (1937) discusses, complete contract development and enforcement are difficult. Because of this difficulty firms may be better off purchasing other firms that already produce the inputs needed instead of contracting with them.

If a firm begins producing its own inputs, it may not continue to do so indefinitely. Cotterill (2001) discusses and builds upon the work of Stigler (1951) who lays out a theoretical framework for the process by which small firms begin by incorporating several production processes for which there are no other firms to produce these specialized products. Over time, output expands until the individual processes within the firm experience decreasing returns. This will lead to market entry and a competitive market structure. Then, according to Stigler, economic growth and spin-offs by the original firm would increase the optimal scale. Cotterill also discusses how mergers, or more specifically, leveraged buyouts (LBOs) impact firm value, pointing out that in many cases the only increases in value are the fees paid to the coordinators of the LBOs. And in the case of supermarkets, horizontal mergers have been used to increase pricing power but have not successfully increased firm value.

Grossman and Hart (1986) develop a theoretical model to try to discover under what circumstances a firm will be better off by contracting with another firm than by owning it. The results are stated as follows:

> If total and marginal benefits of investment move together, firm *i* ownership of firms *i* and *j* will lead to overinvestment by firm *i* and underinvestment by firm *j*. On the other hand, nonintegration will lead to moderate investment levels by each firm. The optimal ownership structure will be chosen to minimize the overall loss in surplus due to investment distortions. (p. 710)

This result indicates that an integration strategy will be pursued if one firm's investment decision is more important than that of the other firm and nonintegration will be pursued if the investment decisions of both firms are less important.

Besanko, Dranove, and Shanley (2000) and Porter (1980) refer to the decision to vertically integrate as the "make versus buy" decision. These decisions must be made regarding activities both above and below a firm's current activities on the value chain.[1] For example, manufacturers must decide if they should produce and store their own inputs or whether they should store and sell their own outputs. The factors that influence the make or buy decision are varied and complex. Porter (1980) discusses the various strategic benefits and costs of these decisions which are outlined below:

- Strategic benefits of integration
  - Economies of Integration
    - Economies of combined operations
    - Economies of internal control and coordination
    - Economies of information
    - Economies of avoiding the market
    - Economies of stable relationships
  - Tap into technology
  - Offset bargaining power and input cost distortion
  - Enhanced ability to differentiate
  - Elevate entry and mobility barriers
  - Enter a higher-return business
  - Defend against foreclosure
- Strategic costs of integration

[1] "Above" refers to activities that are upstream or backwards on the value chain. In other words, those activities that are closer to the producers of raw inputs. "Below" refers to activities that are downstream or forward on the value chain. In other words, those activities that are closer to the consumer.

- Costs of overcoming mobility barriers
- Increased operating leverage
- Reduced flexibility to change partners
- Higher overall exit barriers
- Capital investment requirements
- Foreclosure of access to supplier or consumer research and/or know-how
- Maintaining balance
- Dulled incentives
- Differing managerial requirements

Porter (1980) also discusses specific strategic issues associated with integrating forward and backward in the value chain. These include improved ability to differentiate the product, access to distribution channels, better access to market information, and higher price realization. Strategic issues in backward integration include proprietary knowledge and differentiation.

According to Porter (1980), when firms are making vertical integration decisions there are several myths that can arise that can keep firms from making an appropriate decision. These common myths are:

1. A strong market position in one stage can automatically be extended to the other.
2. It is always cheaper to do things internally.
3. It often makes sense to integrate into a competitive business.
4. Vertical integration can save a strategically sick business.
5. Experience in one part of the vertical chain automatically qualifies management to direct upstream or downstream units.

Each firm's situation is different and while the above statements may be true in some cases they are certainly not true in every case.

2.1.2. Integration in the Food Economy

Barkema, Drabenstott, and Welch (1991) discuss why food markets are changing and moving toward alternative market structures such as contracting and vertical integration. As consumers demand more specialized products, channels must be developed to manufacture and market the increasing number of specialized products. The previous system was not able to handle the changing market situation so new structures are being developed to shorten communication channels and make sure the wide variety of consumer needs can be met in an efficient manner. Firm strategies such as vertical integration can help accomplish this goal. Sexton (2000) implies that vertical coordination has been able to move the market toward this goal by allowing firms to meet consumer's needs for specialized, high-quality products. Also, horizontal coordination has been able to take advantage of economies of improved processing technologies and marketing techniques.

Bhuyan (2001) provides one of the few empirical studies to investigate the impact of vertical mergers on profitability of the firm in the agricultural economics literature. The author develops an industry level empirical model for 43 food manufacturing SIC codes in which net industry profit is the dependent variable. The explanatory variables include an indicator of forward vertical mergers, a productivity index, four firm market concentration (CR4), a regional dummy variable, advertising to sales ratio, research and development expenditures to sales ratio, capital to sales ratio, import to sales ratio, and domestic demand. Data for Bhuyan's study were gathered from a number of public information sources including the National Bureau of Economic Research (NBER) and results from various years of the U.S. Department of

Commerce *Census of Manufacturers*. The regression analysis indicated that the vertical merger indicator variable had a negative impact on the profitability of the food manufacturing industries studied. Therefore the author states that, according to his findings, "forward vertical mergers failed to create or contribute to the creation of differential advantage or efficiency of the integrated firms in U.S. food manufacturing industries." The analysis also indicated that increased market concentration positively and significantly influences profitability.

Hennessy (1996) summarizes the integration literature in agricultural economics. He suggests that firm structure, desire to reduce variability in supply, and cost of testing for quality are the three most common reasons discussed in the literature for integration in the food economy.

Table 1 in Frank and Henderson (1992) shows the extent of vertical integration in the food processing sector in 1982. The range was zero percent to 44 percent (macaroni and spaghetti). A vertical coordination index is constructed using an input-output matrix to determine upstream and downstream coordination in the food manufacturing industry. The data used are from the U.S. Department of Commerce *Census of Agriculture* and *Census of Manufacturers* as well as other authors. The vertical coordination index is then used as the dependent variable in regression analysis. Input uncertainty, concentration, and asset investment were significant determinants of vertical integration.

As discussed in Chapter 1, the change in organizational form is not shifting to one particular strategy but instead to a wide variety of strategies. As this organization and coordination of agricultural markets changes, the implications can be vast and varied. Therefore several authors have sought to summarize these changes and the impacts on the market. Young and Hobbs (2002) sum up the current trend as follows, "closer vertical coordination has occurred as the use of spot markets has declined, while production and marketing contracts, franchising strategic alliances, joint ventures, and full vertical integration have increased."(p. 428) As contracting and integration become more prevalent, the availability and relevance of open market prices decrease. Also, measuring and verifying quality becomes more difficult. MacDonald et. al. (2004) also discuss the trends in agricultural organizational form. Their discussion is mainly related to contracting but vertical integration is also included. They focus on contracting because it is actually more prevalent now than vertical integration in agricultural production. MacDonald et. al. indicate, as did several of the authors discussed above, that vertical coordination will likely continue to increase to allow for consistent supply and quality of agricultural products.

Lubatkin et. al. (2001) investigates the performance benefits that arose from two horizontal mergers in the food manufacturing industry, R.J. Reynolds' acquisition of Nabisco in 1984 and Nestlé's acquisition of Carnation Company in 1984. The authors use data from 1985 to 1990. They use seemingly unrelated regression on six equations (one for each year) that contained extramarket performance (returns that exceed those normally achieved in the market place) as the dependent variable and variables such as market share change, market concentration and market growth as independent variables. The conclusions from the analysis were that the performance benefits of horizontal mergers depend on four competitive factors: where (the characteristics of the product-markets), when (the influence of firm, industry, and population), who (firms are not equally capable of benefiting from horizontal merger), and how (both relative market share and relatedness influence success).

2.2 Diversification

Much of the diversification literature in finance is motivated by unrelated diversification. That is, firms pursuing diversification that is unrelated to their core business as a means of creating a portfolio. While both related and unrelated diversification literature is discussed below, this research refers to unrelated diversification as simply diversification and calls related diversification horizontal or vertical integration as discussed above.

Martin and Sayrak (2003) present a survey of recent literature on corporate diversification in which they point out two distinct sections of the literature which deal specifically with the benefits and costs of diversification. The first two sections below, discussing the benefits of diversification and the costs of diversification, are adapted from Martin and Sayrak's work.

2.2.1 Benefits of Diversification

As discussed in the introduction, there are several benefits to diversification that may induce a firm to adopt a diversification strategy. This section highlights some articles that have discussed these benefits.

In a 1994 article, Montgomery examines three comprehensive views on the motivation for diversification. The market power view refers to a firm's desire to decrease competition through diversification. The resource view theorizes that rent-seeking firms choose to diversify in response to excess resource capacity. The agency view refers to the various benefits managers may receive from diversification.

Lewellen (1971) gives the following four sources of gain from a merger, several of which correspond to the views presented by Montgomery (1994):

1. Opportunities for economies of scale or other direct efficiencies in manufacturing.

2. The enhancement of competitive sales positions through augmented monopoly power.
3. A complementarity in research and basic technological expertise relating to new products.
4. A convenient fit of scarce managerial skills leading to greater administrative efficiency.

Amihud and Lev (1981) suggest that there is often a managerial motive for pursuing diversification. Managers want to reduce their 'employment risk' or the risk of losing their job or professional reputation. This can be done by spreading firm risk over more activities through a conglomerate merger. Firm risk is often closely related to personal risk for a manager whose income is directly influenced by the financial success of the firm through profit-sharing, stock options, bonuses, etc.

Firms differ in how much control a manager has over diversification decisions and this decision is most pronounced between owner-controlled and manager-controlled firms. Amihud and Lev (1981) test the hypothesis that diversification decisions are influenced by managers' preferences in two different ways using Standard and Poor's Compustat data for 309 firms from 1961 to 1970. The first test uses a linear regression model to determine the effects of the type of firm control (strong owner control, weak owner control, and manager control) on the number and type (horizontal, vertical, or conglomerate) of acquisitions undertaken by a firm while controlling for the size of the firm. This model indicates that manager-controlled firms engage in more conglomerate mergers than owner-controlled firms. The second test also uses a linear regression model to determine the effect of the type of control on the degree of diversification and finds that the activities of manager-controlled firms are more diversified than owner-controlled firms.

Aggarwal and Samwick (2003) studied why managers diversified their firms. Their model offers two reasons: 1) to reduce risk and 2) to capture private benefits. Private benefits from diversification could include improving future career prospects (Gibbons and Murphy 1992) and increased prestige, power, and perquisites of running a more diversified firm (Jensen 1986, Stulz 1990). Other private benefits include increased pay (Jensen and Murphy 1990) and more opportunities for skimming[2] (Bertrand and Mullainathan 2001) because a larger and/or more complex firm provides more resources from which managers can draw.

Aggarwal and Samwick use data from Standard and Poor's Compustat and ExecuComp data sets for 1993 to 1998 to empirically estimate a model with Tobin's *q*[3] as the dependent variable. The independent variables include CEO incentives, team incentives, diversification, number of segments, leverage, and several other financial ratios. In contrast to previous literature, their findings suggest that, managers do not diversify to reduce risk exposure. Instead, they respond to the private benefits of diversification. When the private benefits of diversification increase, managers will diversify more.

Another benefit of diversification, as suggested by Stein (1997), is that managers have more information than external capital markets and, therefore, can allocate resources more efficiently in diversified firms than in external capital markets. Stulz (1990) points out that internal capital markets are also larger in diversified firms and underinvestment is decreased.

---

[2] Skimming refers to managers taking advantage of resources and privileges.
[3] Tobin's *q* is the ratio of the market value of a firm's assets (as measured by the market value of its outstanding stock and debt) to replacement cost of the firm's assets (Tobin, 1969).

2.2.2 The Costs of Diversification

While there are managerial benefits to diversification, there are also managerial costs. Most of the literature that discusses costs of diversification refers to the managerial agency problems that arise (Martin and Sayrak 2003). In other words, managers tend to overinvest when there is free cash flow, and when a firm is diversified there is likely to be free cash flow which aggravates the overinvestment problem (Jensen 1986).

Meyer, Milgrom, and Roberts (1992) speak specifically to the disadvantageous labor situation created by mergers and divestitures. A divestiture refers to a firm selling an individual segment to a new owner. They point out that special influence costs arise when managers are trying to protect their jobs from a potential layoff.[4]

Another cost of diversification is the asymmetric information problem between corporate and division management in a diversified firm (Harris, Kriebel, and Raviv 1982). Asymmetric information can be a problem in any firm where the headquarters are far from local divisions but diversification can magnify the problem. This could be because the managers have been integrated into the firm from an acquisition or the firm operates in segments that are not synergistic. Asymmetry can arise from lack of information on the part of one party or from conflicting goals between corporate and division management (Harris, Kriebel, and Raviv 1982).

2.2.3 Diversification and Firm Performance

Maksimovic and Phillips (2002) use data from manufacturing firms from 1975 to 1992 to determine how firm characteristics influence diversification decisions. Three main results follow from their analysis. First, plants of single-segment firms are more productive than plants of conglomerate firms that are of a similar size, except for the smallest plants. Second, productivity

[4] Influence cost refers to any cost that arises such as loss of work time due to politicking and campaigning.

patterns within the segments of conglomerate firms are consistent with a simple value-maximizing model. This supports the hypothesis by the authors that firms invest where they have comparative advantage. Third, segment growth is strongly related to fundamental industry factors and productivity of individual segments. Maksimovic and Phillips (2002) measure productivity in terms of total factor productivity (TFP) where TFP compares the actual amount of output produced for a given amount of inputs to the output the plant should have produced given the inputs used.

Wernerfelt and Montgomery (1988) use Tobin's *q* as a measure of firm performance and find that industry effects are the major determinants of firm success. This is done by estimating a model with Tobin's *q* as the dependent variable and values that might vary by industry as dependent variables. These industry effects include investments in fixed capital, advertising, and research and development. Industry effects exist in the form of positive focus effects. An example of a focus effect would be that widely diversified (less-focused) firms cannot transfer competencies in one market to many other markets. This means that, according to the authors, some differences in performance can be explained by the differences that arise when competency is transferred to widely varying markets.

According to Comment and Jarrell (1995), the widespread diversification trend that had been prevalent since the 1950s began to reverse in the late 1980s, possibly due to the negative economies of scope during this period. The analysis undertaken by Comment and Jarrell focuses on the fact that diversified firms do not take advantage of some of the efficiencies that motivate diversification, specifically:

- Diversification permits a greater use of debt (because the coinsurance of debt reduces default rates).

- Diversification permits a substitution of intersegment cash transfers for arms-length transactions (because transaction costs are lower in internal capital markets than external capital markets).
- Diversification increases the likelihood of takeover because (conversely) these intersegment transfers accommodate a waste of free cash flow.

Comment and Jarrell (1995) find that, in the years 1979 to 1989, debt is not increased through diversification and reliance on external capital markets does not decrease. But, there is some evidence that diversification increases the likelihood of a takeover.

2.2.4 Related versus Unrelated Diversification

Whether diversification is related or unrelated is one of the most prolific sections of the diversification literature. The literature seems to indicate that relatedness of a firm's business operations is thought to be one of the most important factors in the success of a diversified firm.

Ding, Caswell, and Zhou (1987) examine the effects of related and unrelated diversification using Compustat data for 35 food manufacturing firms from 1981 to 1989. As originally outlined by Salter and Weinhold (1979), they consider diversification to be related if it involves businesses that:

- serve similar markets or use similar markets or use similar distribution systems,
- employ similar production technologies,
- exploit similar science-based research, or
- operate at different stages of the same commercial chain.

If diversification does not fall into any of these categories, it is unrelated. For example, Sara Lee's branded apparel segment would be considered unrelated diversification relative to its branded food and beverage businesses.

Ding, Caswell, and Zhou (1987) use two different measures of firm performance as dependent variables in a single-equation multivariate model. Return on equity was used to measure firm performance in terms of the efficiency with which profits are generated from a given bundle of capital. Changes in stock price plus dividends paid was the second firm performance measure used and was intended to measure firm performance from the stockholder's perspective. The independent variables were related diversification, unrelated diversification, relative market share, four-firm concentration ratio, and sales growth rate. The results of the regressions indicated that related diversification is positively related to stock market value but unrelated diversification did not show a negative relationship. This may be due to the ambiguity of the SIC codes for defining related and unrelated diversification. The profitability measure shows only a very weak relationship between performance and diversification.

Christensen and Montgomery (1981) use data from 1972 to 1977 to investigate the suitability of a nine category diversification strategy classification system originally proposed by Rumelt (1974). The nine categories are: single, dominant, dominant vertical, dominant constrained, dominant linked, dominant unrelated, related, related constrained, related linked, unrelated, multi-business, and unrelated-portfolio.[5]

Rumelt's work improved on the previous classification of related and unrelated diversification by assigning more detailed and specific definitions to each class. Therefore, Christensen and Montgomery use Rumelt's framework to discuss how market characteristics influence the type of diversification undertaken by a firm. If, for example, a firm is in a 'low

[5] See Rumelt (1974) for category definitions.

opportunity' market it will likely not gain much through constrained diversification.[6] Therefore, it will likely pursue unrelated diversification. Several findings of this study could be useful to managers. Specifically, constrained diversification does not assure high earnings. Also, managers should avoid highly fragmented, low profit markets if the businesses in these markets are being purchased just for the attractive price. A longer run view is essential in this situation to assess whether there is profit potential in the future regardless of the current price.

Palepu (1985) explores the profitability of related versus unrelated diversifying firms over time using data from 30 firms during the years 1973 to 1979. The study reveals several important findings. First, the profitability of firms that diversify into related activities is significantly greater than that of firms that diversify into unrelated activities. Second, this profitability persists over time for firms that continue to engage in related diversification.

Nayyar (1993) measures the relative performance effects from two possible benefits of diversification: information asymmetry and economies of scope. If either one of these benefits is present, related diversification results. This study specifically looks at a random sample of 513 service firms. The author found that there are significant differences in performance between the benefits of information asymmetry and benefits of economies of scope as measured by stock market reactions to diversification activities. Specifically, seeking benefits from information asymmetry was perceived to be more valuable than seeking benefits from economies of scope. This seems to indicate that not all related diversification has the same effect on value, at least from a stock market valuation perspective. The reason for the related diversification is also influential.

[6] Constrained diversification refers to diversification that builds on a single strength or resource associated with the original business (Christensen and Montgomery 1981).

2.2.5 The Diversification Discount

There are many studies investigating the existence of the diversification discount, some of which are discussed below. Table 2.1 summarizes the research discussed in this study that investigate the diversification discount.

Papers by Lang and Stulz (1994), Berger and Ofek (1995), and Servaes (1996) were among the first to show the existence of this discount for multiple-segment firms relative to single-segment firms.[7] A segment refers to a part of a firm that operates under a different four-digit U.S. Department of Commerce Standard Industrial Classification (SIC) code than other parts of the firm.[8]

Berger and Ofek (1995) give the following reason for trying to determine the value of diversification:

> Theoretical arguments suggest that diversification has both value-enhancing and value reducing effects. The potential benefits of operating different lines of business within one firm include greater operating efficiency, less incentive to forego positive net present value projects, greater debt capacity, and lower taxes. The potential costs of diversification include the use of increased discretionary resources to undertake value-decreasing investments, cross-subsidies that allow poor segments to drain resources from better-performing segments, and misalignment of incentives between central and division managers. There is no clear prediction about the overall value effect of diversification. (p. 40)

Berger and Ofek (1995) use an excess value model of firm value to measure the diversification discount. Excess value is calculated by computing values for each individual business segment and comparing the sum of these values to the actual value of the firm as a whole. If the sum of the values of the individual segments is greater than the actual value of the

---

[7] Recall that in finance literature diversification refers to related and unrelated diversification unless otherwise noted.
[8] The SIC code system becomes increasingly specific as numbers are added to the code. For example, SIC 20 indicates Food and Kindred Products manufacturing, SIC 205 indicates Bakery Products, and SIC 2052 indicates Cookies and Crackers. See Appendix A for more details.

firm, excess value exists that may be attributable to diversification. This excess value is the value lost from diversification or the "diversification discount." The excess value formula is defined as $EV = \ln(V / IV)$ where V is the sum of the market value of equity and the book value of debt and IV is the sum of the imputed values for each individual business segment. Due to the costs of diversification discussed in literature, which are particularly high in conglomerate firms, Berger and Ofek hypothesize that a diversification discount does exist.

The data used by Berger and Ofek (1995) include information for 3,659 firms from 1986 to 1991. Firms in the financial sector as well as firms with sales below $20 million are excluded. Firms in the financial sector are excluded because they do not report information on earnings before interest and taxes (EBIT) due to the fact that this value has no meaning in financial companies.

To provide additional evidence for the relationship between firm value and diversification, the excess value measure is used as the dependent variable in a regression model that includes a binary variable for diversification whose regression coefficient gives the percentage difference in average excess value between focused and diversified firms. Various firm effect variables are also included, specifically firm size, profitability, and growth. As hypothesized, there is an average value loss from diversification. The value loss ranged from 13% to 15%. This regression is then extended to see how relatedness of the diversification and year influences the regression results. Firm segments are considered unrelated if they have different SIC codes at the two-digit level. For related diversification, the value loss is found to be much less. Also, the results vary between time periods. Berger and Ofek (1995) also examine the profitability of diversified versus single-segment firms and find that profitability (measured by EBIT divided by sales and EBIT divided by assets) is lower for diversified firms.

Overinvestment by diversified firms is said to be a source of value loss. To examine whether this is true, Berger and Ofek (1995) regress the excess value calculation described above on a measure of overinvestment and control for assets, EBIT, and capital expenditures. Overinvestment for a firm is defined as the sum of depreciation-adjusted capital expenditures for all of the segments of the firm whose median Tobin's *q* is in the lowest quartile, scaled by total sales. Higher values of overinvestment, as it is defined here, represent more unprofitable investments. The results suggest that overinvestment is correlated with lower value for diversified firms.

Lang and Stulz (1994) use Tobin's *q* as a measure of firm value and find that it is negatively related with firm diversification throughout the late 1970s and 1980s. They find that single-segment firms are valued more highly than diversified firms by capital markets. Examining the mean and median Tobin's *q* for diversified firms, the authors find that these values are below the sample average of nondiversified firms for each year in the sample.

Lang and Stulz (1994) also investigate whether the relationship between Tobin's *q* and diversification can be explained by industry effects. Lang and Stulz use size, research and development investments, and ability to access financial markets as industry effects. The analysis of industry effects is done by compiling portfolios of specialized firms that resemble diversified firms. This analysis reveals that the magnitude of the diversification discount is reduced by accounting for industry effects. Further analysis indicates industry effects do not explain the entire diversification discount but they do explain some of it.

Servaes (1996) also analyzes the diversification discount using data from 1961 to 1976. He finds that there is a discount in the 1960s but it declines to nearly zero in the early and mid-1970s. In contrast to the other studies, this paper examines the effect of insider ownership on diversification. When the diversification discount was large (1961-1970) the firms with high insider ownership resisted diversification but when the diversification discount declined, these firms quickly diversified.

Katchova (2005) uses the same method as Berger and Ofek (1995) but applies it to farm level data, specifically U.S. Department of Agriculture (USDA), National Agricultural Statistics Service's (NASS) Agricultural Resource Management Survey (ARMS) data from 1999, 2000, and 2001. All farms with total assets of $40,000 or more and a value of total production of $10,000 or more were used in the sample. Farms with extreme excess values were excluded. After screening, the sample included 15,030 farm observations from 1999 to 2001, 9,088 specialized crop or livestock farms and 5,942 crop/livestock diversified farms. The methods used by Katchova had to be changed slightly from the Berger and Ofek model to account for the definitions of diversification at the farm level. As mentioned above, corporate firms use SIC codes to define segments, but for farms the diversification is defined by either crop or livestock production. Within either the crop or livestock group the farms can then be separated by commodity (corn, hogs, soybeans, etc.). Katchova finds a diversification discount of 5.8% for crop/livestock diversified farms and 9.4% for commodity diversified firms.

Laeven and Levine (2005) examine whether a diversification discount exists in a specific sector of the economy. Laeven and Levine look specifically at financial conglomerates. Their sample comes from Bankscope and includes 836 banks, across 43 countries, over the period 1998 to 2002. They use Tobin's q and an excess value calculation to examine diversification in income and in assets. As has been pointed out by several other authors, firm characteristics that guide diversification decisions can also affect firm value. For this reason, Laevan and Levine use four instrumental variable specifications to control for firm characteristics and endogeneity concerns. These variables are then used in Heckman's (1979) two-step procedure to control for self-selection bias. A diversification discount is found in all cases.

Denis, Denis and Yost (2002) studied whether the diversification discount applies to global diversification as it does to industrial diversification. They find that there is a discount associated with global diversification. Two explanations are given for the diversification discount. First, diversification and firm value are endogenously related, meaning that either firms diversify by purchasing lower-valued firms or lower-valued firms choose to diversify. The other possibility is that diversification destroys value and therefore causes the diversification discount.

Lamont and Polk (2001) approach the diversification discount from the standpoint of the differences in future cash flows and future returns between discounted firms and premium firms. The data and subsequent analysis discussed in this paper find that expected returns are higher in firms with a diversification discount than in premium firms. They find that about half of the variance in excess value can be attributed to differences in future cash flow between diversified and single-segment firms. The other half is due to differences in future returns and covariance between returns and cash flows.

Gomes and Livdan (2004) use a theoretical framework to study the existence of a diversification discount or lack thereof. They use methods similar to those of Lang and Stulz (1994). They find that, as documented by Schoar (2002), expanding firms are less productive than other firms and experience productivity loss after expansion. Also, differences in size account for part of the productivity and valuation differences between diversified and focused firms. The most surprising finding in this study was that the diversification discount found by

Lang and Stulz can be obtained. This is especially interesting considering that, in their model, diversification does not destroy value.

2.2.5.1 Alternative Explanations for the Diversification Discount

Campa and Kedia (2002) argue that, although several studies have proven the existence of a diversification discount, the failure to control for firm effects that lead to diversification and therefore a discount may attribute the discount to diversification when it is really caused by other underlying characteristics. Firms choose to diversify and make this decision based usually on a complex set of circumstances. Following analysis using Compustat data from 1978 to 1996, they find that the correlation between diversification and firm value is not causal. This conclusion is reached by using instrumental variables to control for exogenous characteristics that predict the decision to diversify.

Graham, Lemmon, and Wolf (2002) contend that analyzing segments of firms as if they were stand-alone firms (as is done by Berger and Ofek) is not appropriate. They believe that divisions of diversified firms are systematically different than stand-alone firms. For example, sometimes firms are priced at a discount before becoming part of a merged firm. The authors use Compustat data for 356 firms from 1980 to 1995 that have made acquisitions and account for the existing characteristics of the acquired firms. They find that these characteristics explain nearly all of the reduction in the excess value of the acquiring firm after the merger, regardless of the type of acquisition and type of firm.

Villalonga presents two different studies that seek to refute the existence of the diversification discount. The first study (2004a) hypothesizes that the diversification discount could be due to the inappropriateness of the segment data that is used to measure it in most previous studies. She uses Business Information Tracking Series data for the whole US economy from 1989 to 1996, which allows for construction of business units that are more comparable across firms. This data actually indicates a diversification premium that is robust with variations in measures of excess value and diversification. A second study by Villalonga (2004b) also causes the diversification discount to disappear, this time when econometric methods of casual inference are used. Here she compares the performance of three different techniques from previous literature that seek to establish causation from non-experimental data.[9] All three of the methods show no indication of a diversification discount as it is traditionally defined.

Mansi and Reeb (2002) argue that the diversification discount discussed in previous literature stems from risk-reducing by corporations that choose to diversify. The data used is from the Disclosure WorldScope database and includes 2,856 firms from 1988 to 1999. The authors' hypothesis is supported by the following three findings: equity holder losses in diversification are related to firm leverage, all-equity firms do not exhibit a diversification discount, and using book value of debt in the measure of excess value creates bias that is related to diversification. They also find that, using their data, the relation between diversification and firm excess value is not significant.

Rajan, Servaes, and Zingales (2000) explore the distortions between decisions made within the organization and decisions made in the marketplace. Instead of considering a division manager and headquarters, the authors consider two division managers battling for resources that can be given to the manager or transferred to another division by headquarters. The effect of this struggle on firm value is the basis for analysis. The analysis reveals that funds will flow from divisions with poor opportunities to divisions with good opportunities. However, this is not the

---

[9] See Dehejia and Wahba (1999), Abadie and Imbens (2002), and Heckman (1979).

case all the time. In a diversified firm, resources may have to be allocated to support certain divisions, even if they are performing poorly. Therefore, when diversity is low, transfers are made in the appropriate direction and firms trade at a premium (positive excess value) relative to single-segment firms. When diversity increases, the firm starts trading at a discount and the discount increases as diversity increases.

Table 2.1 Summary of Reviewed Diversification Discount Literature

Author and Year	Data	Summary
Lang and Stulz, 1994	Compustat, 1978 to 1988	Using Tobin's *q* as a measure of firm value the authors find a diversification discount. Also, the magnitude of the diversification discount is influenced by industry effects.
Berger and Ofek, 1995	Compustat, 1986 to 1991	Using an excess value measure of firm value, the authors find a diversification discount. For related diversification, the value loss is much less.
Servaes, 1996	Compustat, 1961 to 1976	Servaes finds that there is a diversification discount in the 1960s but it declines to nearly zero in the early and mid-1970s. When the diversification discount was large (1961-1970) the firms with high insider ownership resisted diversification but when the diversification discount declined, these firms quickly diversified.
Rajan, Servaes, and Zingales, 2000	Compustat, 1980 to 1993	Authors analyze how inefficient investment influences firm value. When diversity is low, transfers are made in the appropriate direction and firms trade at a premium (positive excess value) relative to single-segment firms. When diversity increases, the firm starts trading at a discount and the discount increases as diversity increases.
Lamont and Polk, 2001	Compustat, 1979 to 1997	Expected returns are higher in firms with a diversification discount than in premium firms. Authors find that about half of the variance in excess value can be attributed to differences in future cash flow between diversified and single-segment firms. The other half is due to differences in future returns and covariance between returns and cash flows.
Campa and Kedia, 2002	Compustat, 1978 to 1996	The authors find that the correlation between diversification and firm value is not causal.
Denis, Denis, and Yost, 2002	Compustat, 1984 to 1997	Authors find a diversification discount associated with global diversification.
Graham, Lemmon, and Wolf, 2002	Compustat, 1980 to 1995	The authors contend that diversified firms tend to purchase already discounted firms which produces the diversification discount. Their analysis reveals that if characteristics of the firm being acquired are taken into account, nearly all of the diversification discount can be explained.
Mansi and Reeb, 2002	Worldscope, 1988 to 1999	According to the analysis done by Mansi and Reeb, the relation between diversification and firm excess value is not significant.
Gomes and Lividan, 2004		Authors use a theoretical framework to study the existence of a diversification discount. They find that expanding firms are less productive than other firms and experience productivity loss after expansion. Also, differences in size account for part of the productivity and valuation differences between diversified and focused firms. The diversification discount can be obtained using their theoretical framework.
Villalonga, 2004a	Compustat and BITS, 1989 to 1996	Villalonga hypothesizes that the diversification discount could be due to the inappropriateness of the segment data that is used to measure it in most previous studies. BITS data actually indicates a diversification premium that is robust with variations in measures of excess value and diversification.
Villalonga, 2004b	Compustat, 1978 to 1997	Econometric methods of casual inference are used which cause the diversification to disappear. She compares the performance of three different techniques from previous literature that seek to establish causation from non-experimental data. All three of the

		methods show no indication of a diversification discount as it is traditionally defined.
Katchova, 2005	ARMS, 1999 to 2001	Katchova uses farm survey data and finds a diversification discount in both crop/livestock diversified farms and crop diversified farms.
Laeven and Levine, 2005	Bankscope, 1998 to 2002	Using a variety of statistical methods and instrument variable specifications, a diversification discount is found in all cases in their sample of financial institutions.

2.3 Family-Controlled Firms and Firm Performance

Family control is an important firm effect variable in the food processing, wholesale grocery, and retail supermarket sectors. The food economy has many companies controlled by families. Anderson and Reeb (2003) report that 43 percent of all food processing firms are controlled by families. Villalonga and Amit (2005) report that 42 percent of food processing firms, 36 percent of grocery wholesale firms, 55 percent of retail grocery firms, and zero percent of restaurant firms are family controlled. Villalonga and Amit (2005) define family controlled firm as those firms in which one or more family members are officers or directors or own more than 5 percent of the firm's equity.

Anderson and Reeb (2003) use data from S&P 500 firms in 1992 to 1999 to find that family firms are significantly better performers than non-family firms when a profitability-based measure of firm performance (ROA) is used. Their results suggest that firms controlled by founding families are more profitable than dispersed-ownership firms. They also find that profitability is even greater when a family member is the CEO. One explanation Anderson and Reeb offer for this finding is that family members understand the business and feel a strong sense of responsibility for its performance.

Boland, Golden, and Tsoodle (2006) found that ownership structure (e.g, family controlled firms and cooperatives), governance variables, and income distribution methods were significant determinants of food processing firm profitability over the 1992 to 2002 time period using Compustat data. Greater performance is linked with a greater number of independent directors and firms that pay cash dividends or cash patronage refunds.

2.4 Contributions to Current Literature

The contribution of this research is to further refine the diversification binary variable used in the finance literature. More specifically, this variable is disaggregated into variables that measure vertical integration upstream or downstream in the food value chain, horizontal integration across industries in a sector, and unrelated diversification into any industry outside the food economy.

A study looking specifically at diversification and integration in the four distinct sectors of the food economy does not exist in current literature. Also, while vertical integration is widely discussed in the literature, much of the discussions are conceptual or theoretical discussions as opposed to empirical investigations. This is because true measures of vertical integration can be difficult to construct and therefore proxies are used. Those studies that do provide empirical evidence focus mostly on issues such as transaction costs, foreclosures and determinants of vertical integration (Bhuyan 2001). Therefore, it is a useful contribution to the literature to investigate how vertical integration (and diversification) affects firm value in the food economy. As agricultural economists, it is useful to analyze the impact of diversification and integration strategies on food economy firms because they have some unique characteristics. It is also useful to note if there are differences among the retail, processing, wholesaling and restaurant sectors of the food industry. And, in contrast to previous studies in the agricultural economics literature, this study uses a measure of firm value that accounts for the value derived from specific business segments.

2.5 Summary of Literature

This chapter has described the relevant literature on diversification and integration. The contribution provided by this research is to study an important sector of the U.S. economy which has unique characteristics and has four distinct sectors. An approach for measuring performance as a function of firm effects, industry effects and a diversification/integration variable has been identified as a useful way to test for a premium or discount. And, as is evident from the literature discussed above, a database exists that is commonly used in studies of this type.

Several conclusions can be drawn from the literature review above. First, papers have studied the impact of diversification on firm profitability but not many have studied the impact of vertical and horizontal integration. In general, across a wide range of data and time periods, undiversified firms have performed better than diversified firms. Various explanations have been offered for this, including inability to transfer specialized skills to other industries (Porter 1980, Wernerfelt and Montgomery 1988), not taking advantage of the efficiencies that come with diversification (Comment and Jarrell 1995), and lack of effective corporate control and monitoring mechanisms (Berger and Ofek 1995).

The excess value measure proposed by Berger and Ofek has been used and adapted in several different ways since it was first published in 1995. It remains the most widely used method to assign values to segments based on the financial information companies are required to report by segment.

Traditionally Tobin's *q* has been used to assign value to a firm but in this study excess value for firm valuation is used to avoid some of the problems with Tobin's *q* that Berger and Ofek (1995) point out. Specifically, because Tobin's *q* requires calculating a firm's replacement value, assumptions about depreciation and inflation rates must be made. Also, studies using

Tobin's *q* usually do not adjust for industry effects even though there is large variation across industries and industry effects have been found to be significant in explaining the diversification discount. When studying diversification using segment data and Tobin's *q*, it becomes even more difficult to adjust for industry effects because the components of the Tobin's *q* formula cannot be computed from the segment data companies are required to report.

The literature review suggests that variables measuring firm effects and industry effects are important when explaining performance. The literature also suggests that it is important to account for endogeneity concerns, industry classification and data measurement.

CHAPTER 3 - Methodology

To determine whether a premium or discount exists for integration or diversification, a method must be identified to assign value to a firm and its segments. In this case, this firm value measure is called excess value. This chapter discusses the methodology, data, and estimation procedures for modeling this excess value as a function of firm effect variables and binary variables to indicate diversification and integration strategies. The effect of these binary variables is modeled as both an exogenous and endogenous decision.

3.1 Excess Value

Berger and Ofek's (1995) excess value calculation method is used in this research to compare the actual value of a firm to the imputed value of all of the segments of a firm. A segment is defined by a single four-digit US Department of Commerce SIC code.[10] Since 1977, firms have been required to report net sales, assets, depreciation, capital expenditures, and earnings before interest and taxes (EBIT) by segment (Berger and Ofek 1995). For the purposes of this study, a firm is considered to be diversified or integrated if it must report under two or more separate four-digit SIC codes. A firm reports under a specific SIC code if its sales, assets, or EBIT are at least 10% of the firm total.

In each industry, there are firms who operate in only one segment. In other words, they report under only one four-digit SIC code. For these firms, the median ratio of total capital (market value of common equity plus book value of debt) to assets is calculated as

[10] Appendix A provides the SIC classifications, codes, and names used in this study.

(1) $$\frac{V_{mj}}{a_{mj}} = median\left\{\frac{V_{1j}}{a_{1j}}, \frac{V_{2j}}{a_{2j}}, \ldots, \frac{V_{nj}}{a_{nj}}\right\}$$

where V_{ij} is total capital for firm i in segment j, a_{ij} is total assets for firm i in segment j, n_j is the number of firms in segment j, and m is the firm with the median ratio.[11] The median ratios are calculated using the narrowest SIC group that contains three or more firms. For processing firms, 53% of the median calculations use four digit SIC codes, 42% use three digit SIC codes, and 5% use two digit SIC codes. For wholesales firms, 42% of the median calculations use four digit SIC codes and 52% use three digit SIC codes.[12] For retail and restaurant firms, 99% of the median calculations use four digit SIC codes and 1% use three digit SIC codes. An imputed value for each segment of each diversified firm can then be defined, using the ratio in (1), as

(2) $$IV_{ij} = a_{ij} \times \left(\frac{V_{mj}}{a_{mj}}\right)$$

where IV_{ij} is the imputed value for segment j of firm i and a_{ij} is assets for firm i in segment j. The imputed value for the entire firm including all J of its segments is then

(3) $$IV_i = \sum_{j=1}^{J} IV_{ij}$$

where IV_i is the imputed value for firm i. So the excess value, EV, of firm i is

(4) $$EV_i = \ln\left(\frac{V_i}{IV_i}\right)$$

where V_i is total capital for firm i and IV_i is the sum of imputed values for each segment of the firm.[13] If V_i is greater (less) than IV_i then excess value is positive (negative) and the value of the

---

[11] As in Berger and Ofek (1995) and other studies using this excess value calculation method, the median ratio is used instead of the mean ratio to account for skewness in the data distributions.
[12] The percentages for wholesale firms do not sum to 100% because a small number of medians in this sector had to be calculated using data from only one firm.
[13] A numerical example using equations (1) – (4) is shown in Appendix C.

firm is greater (less) than the sum of the imputed value of its segments. Equations (1) to (4) are also calculated using sales in place of assets. Because assets and sales for each firm are multiplied by the median ratio of total capital to assets, these two accounting items are referred to as "multipliers". Two different multipliers are used to calculate excess value because previous literature has indicated that, if managers are responsible for reporting segment data, they may have an incentive to misstate it. Segment assets are specifically identified with each segment so it is difficult to misstate them but managers can use discretion when allocating sales between segments. Therefore, sales are vulnerable to manipulation (Berger and Ofek 1995).

Unallocated assets can become a problem when making the excess value calculations described above. Therefore, if the sum of segment assets differs from the sum of the firm's assets by more than 75% then the firm is excluded from the analysis that uses the asset multiplier. If the difference is within 75%, the imputed value is adjusted up or down by the percent difference between the sum of the segment assets and the total firm assets. The sales multiplier is adjusted in a similar manner. This type of adjustment is also used by Berger and Ofek (1995).

After all firm calculations are complete, outliers are removed for each of the two excess value measures. Outliers are defined as those excess values that are five standard deviations above or below the mean for each of the multipliers. Table 3.1 shows the median and mean excess values broken out by multiplier, sector of the food economy and diversification status as well as the number of observations in each subset.[14]

The single segment median excess values for processing firms is zero as is expected because it is the log of a value that should be close to one for single segment firms. The median

[14] Removing excess value outliers and adjusting for unallocated sales and assets resulted in a decrease in the number of observations from 5,542 to 4,079.

excess value for multi-segment processing firms is -0.7076 using the asset multiplier and -0.6675 using the sales multiplier. The mean excess values for processing firms are -0.5864 using the asset multiplier and -0.5705 using the sales multiplier.

Table 3.1 suggests that diversification and/or integration decreases value most noticeably in the wholesale sector and least in the processing sector. But, these are only preliminary indications of the effect of diversification and/or integration on firm value. The next section examines this relationship further. Table 3.1 indicates that excess value is significantly less in the food economy sector than the entire U.S. economy, as studies by Berger and Ofek (1995) and Campa and Kedia (2002) have found mean excess values between -0.05 and -0.16 using data from the economy as a whole. It should be noted that each of these studies used different time periods. This study of the food economy uses data from a longer time period relative to any of these previous studies and encompasses several significant events in the food economy, including the farm crisis of the mid-1980's, growth in the late 1990's caused by exports, and the food safety issues in the 2000's.

Table 3.1 Mean and Median Excess Values and Number of Observations for Each Type of Food Economy Firm

	Processing	Wholesale	Retail	Restaurant
Median				
Asset Multiplier				
Single-segment firms	0.0000	0.0000	0.0000	0.0000
Multi-segment firms	-0.7076	-1.0192	-0.6525	-0.6426
Sales Multiplier				
Single-segment firms	0.0000	0.0000	0.0000	0.0000
Multi-segment firms	-0.6675	-1.4285	-0.7750	-0.5889
Mean				
Asset Multiplier				
Single-segment firms	0.0429	-0.0095	0.0795	0.0578
Multi-segment firms	-0.5864	-0.8581	-0.6815	-0.6506
Sales Multiplier				
Single-segment firms	0.0158	-0.2018	-0.0640	0.0381
Multi-segment firms	-0.5705	-1.2665	-0.8737	-0.5986
Number of Observations[a]				
Single-segment firms	1,481	134	400	1,313
Multi-segment firms	474	113	71	93

[a]The data set contains 4,079 total observations.

Tables 3.2 to 3.5 show the mean, median, and standard deviation of the excess value calculations by year. The mean values are graphed in figures 3.1 to 3.4. In this sample, the variability of the mean values increases when the number of observations decreases. The greatest variation is in the wholesale sector but this is also the sector with the fewest number of observations. As is evident throughout the subsequent analysis, wholesale firms have had very variable profitability over the time period studied. This is partly due to the structural changes that were discussed in Chapter 1.

Table 3.2 Mean, Median and Standard Deviation of Excess Value for the Processing Sector by Year and Multiplier

		Asset Multiplier			Sales Multiplier		
Year	**N[a]**	**Mean**	**Median**	**Std. Dev.**	**Mean**	**Median**	**Std. Dev.**
1983	32	-0.055	0.000	0.594	-0.148	-0.062	0.793
1984	47	-0.051	0.000	0.711	-0.043	0.000	0.914
1985	49	-0.092	-0.037	0.641	-0.082	0.000	0.756
1986	50	-0.054	0.000	0.539	-0.172	-0.098	0.649
1987	56	-0.069	-0.027	0.546	-0.031	0.000	0.669
1988	58	-0.185	-0.116	0.586	-0.074	-0.086	0.801
1989	61	-0.096	0.000	0.618	-0.048	0.000	0.751
1990	61	-0.092	0.000	0.701	-0.178	0.000	0.815
1991	63	-0.091	0.000	0.759	-0.102	-0.038	0.904
1992	70	-0.050	-0.028	0.659	-0.016	0.000	0.748
1993	80	-0.143	-0.080	0.705	-0.159	-0.097	0.730
1994	87	-0.074	-0.050	0.660	-0.130	-0.040	0.673
1995	96	0.117	0.001	0.624	-0.125	0.000	0.684
1996	101	-0.091	-0.016	0.593	-0.143	0.000	0.584
1997	109	-0.030	0.000	0.680	-0.072	0.000	0.678
1998	122	0.010	0.000	0.728	-0.015	0.000	0.724
1999	124	-0.102	-0.020	0.677	-0.174	-0.075	0.708
2000	127	-0.069	-0.026	0.709	-0.055	-0.019	0.761
2001	127	-0.156	-0.010	0.717	-0.182	-0.072	0.729
2002	120	-0.203	-0.133	0.656	-0.171	-0.095	0.736
2003	119	-0.184	-0.086	0.815	-0.177	-0.138	0.851
2004	118	-0.195	-0.178	0.680	-0.233	-0.096	0.723
2005	78	-0.217	-0.193	0.735	-0.251	-0.035	0.834

[a]N is the number of observations in each year.

Table 3.3 Mean, Median and Standard Deviation of Excess Value for the Wholesale Sector by Year and Multiplier

		Asset Multiplier			Sales Multiplier		
Year	N[a]	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
1983	5	-0.048	0.000	0.788	-0.270	0.000	0.998
1984	7	-0.443	-0.374	0.540	-0.584	-0.413	0.618
1985	7	-0.460	-0.288	0.453	-0.601	-0.343	0.593
1986	7	0.024	-0.054	0.659	-0.292	-0.509	0.557
1987	7	0.028	-0.067	0.694	-0.338	-0.695	0.738
1988	8	-0.292	-0.333	0.459	-0.470	-0.485	0.470
1989	7	-0.551	-0.969	0.737	-0.628	-1.170	1.510
1990	7	-0.537	-0.785	0.871	-1.557	-2.105	1.135
1991	7	-0.276	-0.744	1.198	-0.845	-1.279	1.137
1992	7	-0.413	-0.231	0.856	-0.831	-1.111	1.010
1993	11	-0.552	-0.308	0.813	-0.727	-0.389	1.159
1994	14	-0.260	0.000	0.875	-0.425	-0.175	1.005
1995	14	-0.420	-0.040	0.878	-0.514	-0.234	1.137
1996	15	-0.502	-0.069	0.855	-0.537	-0.739	1.255
1997	16	-0.245	-0.057	0.837	-0.379	-0.349	1.489
1998	17	-0.721	-0.891	0.846	-0.374	-1.276	1.801
1999	18	-0.168	-0.286	1.096	-0.719	-1.378	1.438
2000	18	-0.505	-0.977	1.037	-0.703	-0.722	1.222
2001	18	-1.117	-0.910	0.907	-1.558	-1.842	1.287
2002	11	0.222	0.176	0.959	-1.361	-1.283	0.965
2003	11	-0.206	-0.303	1.000	-0.376	-0.159	0.916
2004	9	-0.374	-0.591	0.795	-0.750	-0.699	0.856
2005	6	-0.424	-0.335	0.869	-0.700	-0.465	0.814

[a]N is the number of observations in each year.

Table 3.4 Mean, Median and Standard Deviation of Excess Value for the Retail Sector by Year and Multiplier

		Asset Multiplier			Sales Multiplier		
Year	**N[a]**	**Mean**	**Median**	**Std. Dev.**	**Mean**	**Median**	**Std. Dev.**
1983	8	-0.114	0.001	0.491	0.069	-0.001	0.780
1984	13	0.095	-0.002	0.421	0.031	-0.085	0.678
1985	13	0.122	-0.024	0.476	0.038	-0.008	0.675
1986	13	0.127	-0.001	0.404	0.095	-0.012	0.634
1987	13	-0.141	0.000	0.461	0.069	-0.020	0.646
1988	13	0.126	0.005	0.371	0.133	0.119	0.516
1989	13	0.154	0.019	0.347	0.035	0.011	0.488
1990	16	-0.017	-0.002	0.519	-0.050	0.000	0.670
1991	18	0.032	0.021	0.521	-0.083	-0.096	0.576
1992	18	0.157	0.005	0.664	0.024	-0.038	0.724
1993	19	0.075	-0.012	0.702	-0.046	0.000	0.756
1994	20	-0.197	-0.062	0.484	-0.178	-0.024	0.636
1995	23	-0.167	-0.061	0.807	-0.213	0.000	0.850
1996	27	0.086	-0.055	0.491	-0.176	-0.010	0.643
1997	29	-0.012	-0.026	0.635	-0.316	-0.002	0.775
1998	29	0.028	-0.014	0.774	-0.237	-0.052	0.886
1999	30	-0.196	-0.071	0.678	-0.364	-0.290	0.876
2000	31	-0.124	-0.276	0.731	-0.288	-0.355	0.797
2001	30	-0.020	-0.086	0.591	-0.352	-0.199	0.759
2002	28	-0.318	-0.341	0.720	-0.448	-0.326	0.952
2003	26	-0.190	-0.126	0.703	-0.289	-0.368	0.712
2004	25	-0.123	-0.054	0.696	-0.254	-0.175	0.726
2005	16	0.015	-0.010	0.742	-0.287	-0.138	0.973

[a]N is the number of observations in each year.

Table 3.5 Mean, Median and Standard Deviation of Excess Value for the Restaurant Sector by Year and Multiplier

		Asset Multiplier			Sales Multiplier		
Year	**N[a]**	**Mean**	**Median**	**Std. Dev.**	**Mean**	**Median**	**Std. Dev.**
1983	14	0.174	-0.009	0.619	-0.036	-0.024	0.947
1984	23	-0.049	-0.008	0.562	-0.087	-0.113	0.645
1985	27	0.052	-0.023	0.603	-0.023	-0.134	0.677
1986	31	0.085	-0.002	0.622	-0.006	-0.162	0.721
1987	32	0.061	0.000	0.663	0.025	0.000	0.692
1988	34	0.076	0.000	0.643	-0.092	-0.004	0.611
1989	37	0.093	0.000	0.740	-0.021	0.000	0.758
1990	40	0.126	0.043	0.737	0.003	0.021	0.837
1991	48	0.183	0.000	0.803	0.278	0.000	0.961
1992	55	0.057	0.022	0.759	0.237	0.012	0.825
1993	60	0.087	-0.011	0.679	0.238	-0.014	0.801
1994	62	-0.018	-0.009	0.634	0.007	-0.057	0.702
1995	72	-0.002	-0.028	0.679	-0.129	-0.050	0.803
1996	83	0.048	-0.005	0.673	-0.009	-0.017	0.814
1997	87	0.033	-0.004	0.563	0.108	0.000	0.746
1998	95	-0.002	-0.043	0.657	0.024	0.000	0.776
1999	98	-0.015	-0.060	0.657	-0.101	-0.113	0.777
2000	100	-0.040	-0.069	0.656	-0.129	-0.061	0.749
2001	94	-0.037	-0.040	0.690	-0.073	-0.050	0.808
2002	92	-0.025	-0.024	0.734	-0.047	-0.024	0.841
2003	79	-0.082	-0.015	0.644	-0.052	-0.004	0.813
2004	79	-0.099	-0.142	0.596	-0.014	-0.073	0.742
2005	64	0.001	0.000	0.584	-0.043	-0.056	0.720

[a]N is the number of observations in each year.

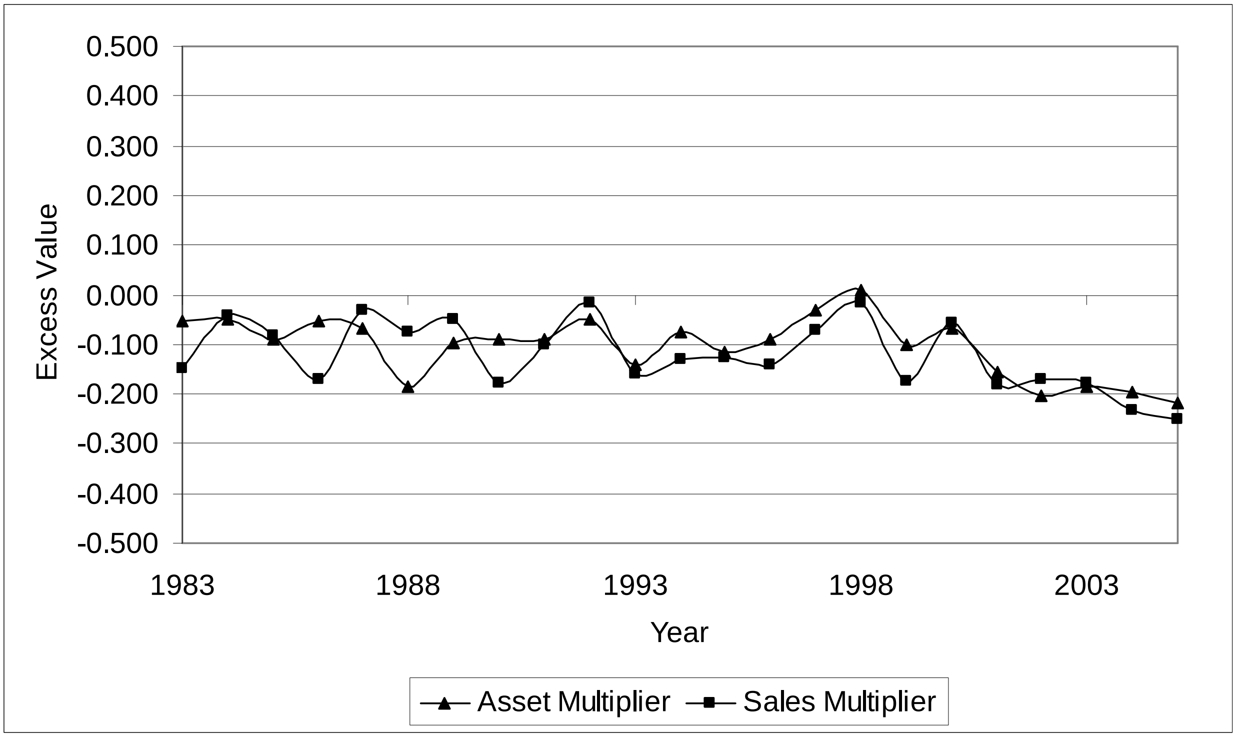

Figure 3.1 Excess Value for the Processing Sector for Each Multiplier

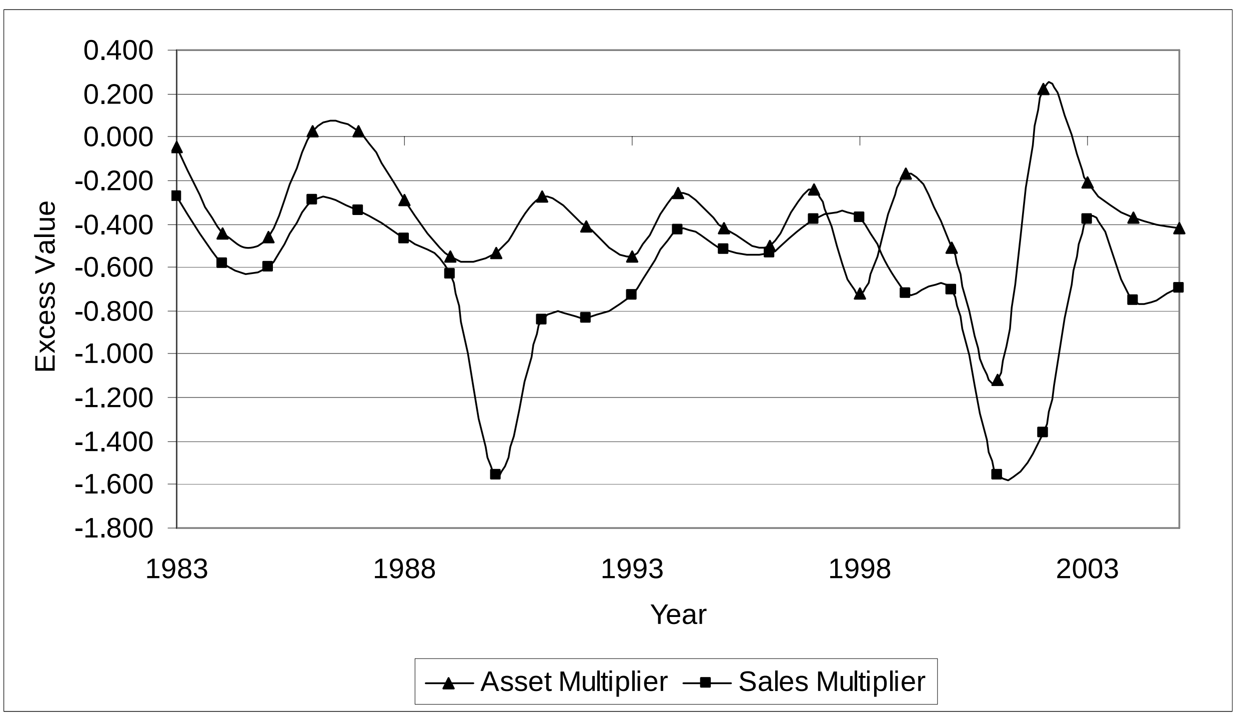

Figure 3.2 Excess Value for the Wholesale Sector for Each Multiplier

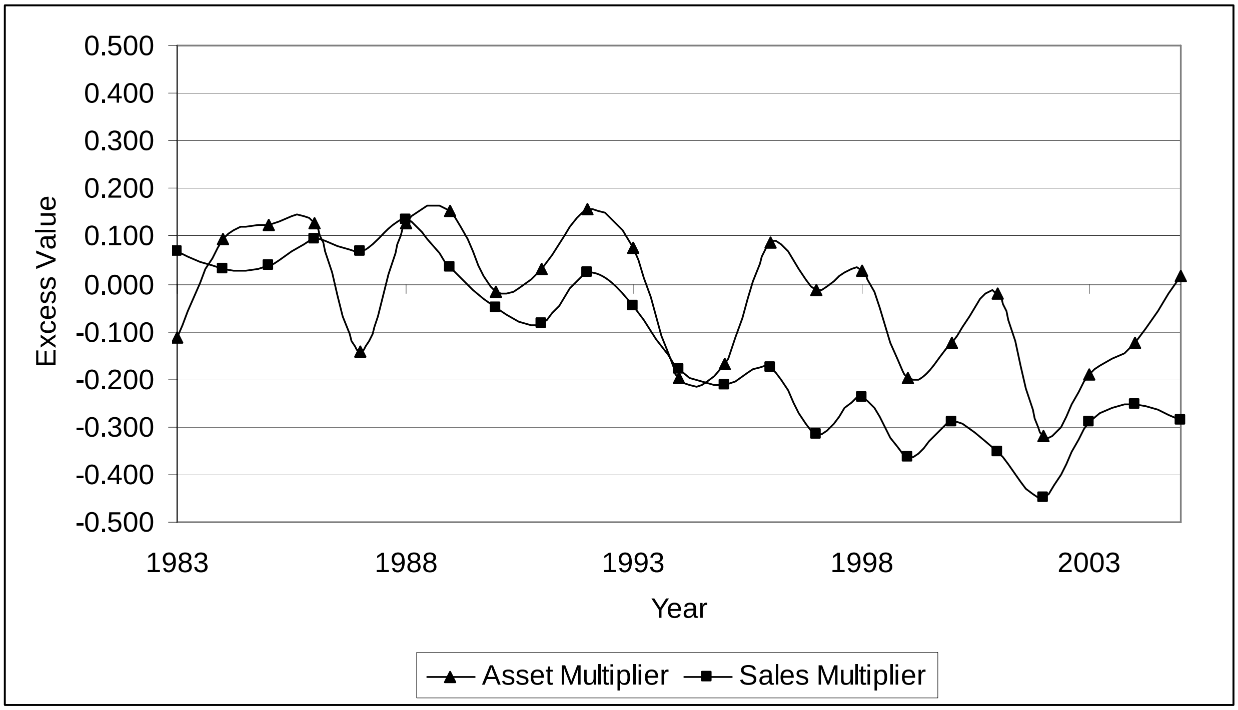

Figure 3.3 Excess Value for the Retail Sector for Each Multiplier

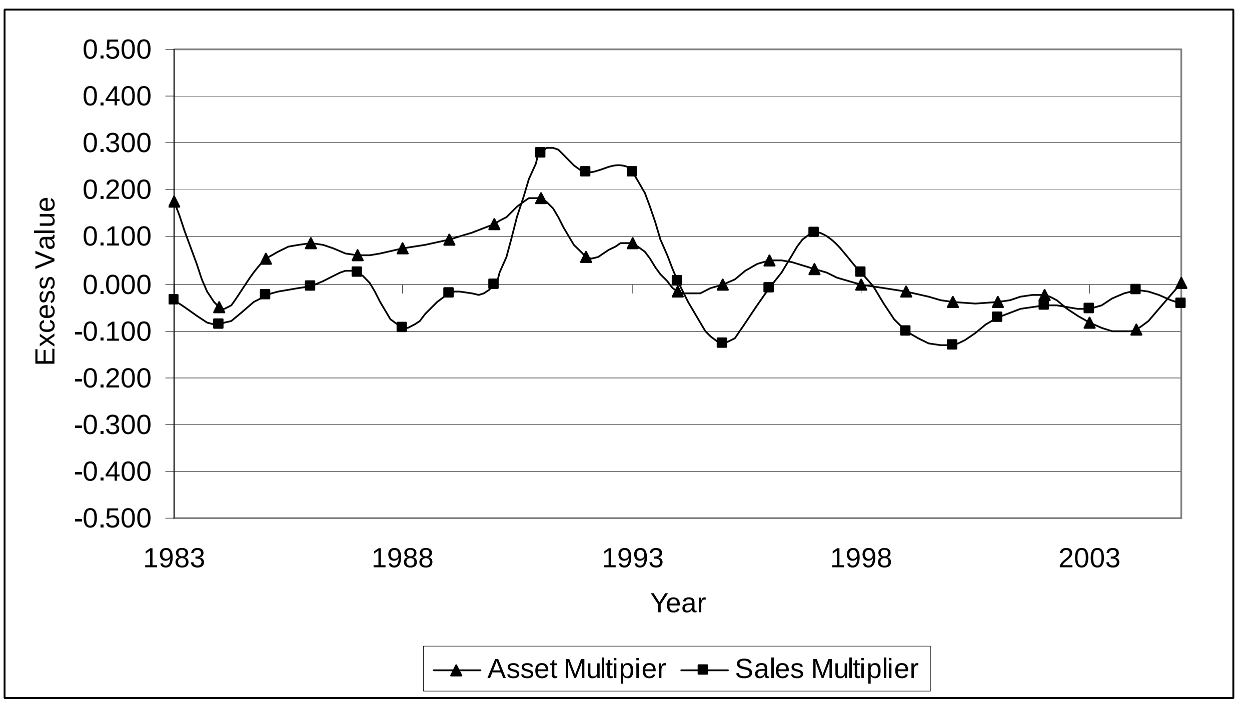

Figure 3.4 Excess Value for the Restaurant Sector for Each Multiplier

3.2 Conceptual Model

This section describes the conceptual models that are used to analyze the impact of firm effects and diversification and integration strategy on excess value. In the first section, the diversification or integration strategy is an exogenously determined variable. In the second section, Heckman's two step procedure is used to test the endogeneity of the diversification and integration binary variables.

3.2.1 Exogenous Integration and Diversification Model

The excess value measure shown in equation (4) is used in the following model to further analyze the effect of diversification and integration on firm value, where diversification and integration are exogenously determined. This means that the model shows how certain firm effects, including diversification and integration, influence excess value, but not how these characteristics influence the diversification or integration decision. The model is estimated for the four sectors of the food economy separately and is defined as

(5) $$EV_{i,t} = \alpha + \beta D_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t}$$

where $EV_{i,t}$ is the excess value of firm i in year t and $D_{i,t}$ is a matrix of binary variables equal to one if firm i in year t is integrated or diversified according to the definitions given in Table 3.6 and 0 otherwise. $X_{i,t}$ is a vector of firm effects for firm i in year t, including the ratio of capital expenditures to sales, net margin, leverage, firm control, and assets. These effects differ by firm due to managerial strategies employed by the firm. All variables in equation (5) including the variables in the $X_{i,t}$ vector are defined in Table 3.2. The parameters to be estimated are α, β, and γ and ε is the error term.

The ratio of capital expenditures to sales, net margin, and assets have been widely used in previous literature as explanatory variables in models using excess value. The ratio of capital expenditures to sales is an indication of firm growth because it indicates the change in capital spending as sales increase. Net margin is the ratio of earnings before interest and taxes (EBIT) to sales and is a measure of firm profitability. The natural log of total assets is used as a measure of firm size. Increased growth, profitability and size are expected to have a positive effect on the excess value of a firm. A quadratic size term is also added because the effect of size on excess value may be nonlinear due to decreasing marginal returns (Campa and Kedia 2002).

Equation (5) also includes variables for leverage and control. Leverage in this study is measured by the debt to asset ratio for each firm and is included because leverage is generally thought to have a negative effect on firm value. The variable to indicate control is included due to the finding by Anderson and Reeb (2003) that family-controlled firms are more profitable than non-family controlled firms. The variable for control is binary and equals one if the founding family controls 25 percent or more of the governance of the firm and 0 otherwise. Family control is an important characteristic of firms in the food economy. Governance, which is a measure of whether a firm is controlled by family members or non-family members, is a firm effect variable. Family firms were identified using corporate histories from Hoovers, The Corporate Library, individual company records including SEC documents, and online data from Anderson and Reeb.

The binary variables ($D_{i,t}$) defined in Table 3.6 were initially assigned into twenty-three different, non-overlapping categories based on the diversification and/or integration strategy they were pursuing in a particular year. Due to the small number of firms in some of the categories, the variables were eventually aggregated into the nine binary variables shown in Table 3.6. The original category definitions and aggregation details are given in Appendix D along with the number of firms in each binary variables category. Notice that $D_{9,i,t}$ only applies to processing firms because there are no firms in the data in the other sectors that are integrated into production. But, integration into production is a widely discussed vertical integration issue in the food economy so this binary variable was included.

For clarification purposes, it is useful to discuss some examples of how the binary variables are assigned. Sara Lee is an example of a processing firm that is vertically integrated into wholesale ($D_{2,i,t}$). So, in the case of Sara Lee, the binary variable for vertical integration into the wholesale sector ($D_{2,i,t}$) is a one and all of the other binary variables ($D_{3,i,t}$ through $D_{9i,t}$) are zero. Notice that vertical integration into processing ($D_{1,i,t}$) does not apply in this case.

Sysco is an example of a wholesale firm that is pursuing horizontal integration ($D_{6,i,t}$) into other forms of food wholesale besides general grocery wholesale. So, in the case of Sysco, the binary variable for horizontal integration ($D_{6,i,t}$) is a one and all of the other binary variables ($D_{1,i,t}$, $D_{3,i,t}$, $D_{4,i,t}$, $D_{5,i,t}$, $D_{7,i,t}$, $D_{8,i,t}$) are zero. Notice that the binary variables that indicate vertical integration into wholesale ($D_{2,i,t}$) and vertical integration into production ($D_{9,i,t}$) do not apply for wholesale firms.

Coles Myers is an example of a retail firm pursuing unrelated diversification ($D_{5,i,t}$) in the form of computer services. So, in the case of Coles Myer, the binary variable for unrelated diversification ($D_{5,i,t}$) is a one and all of the other binary variables ($D_{1,i,t}$, $D_{2,i,t}$, $D_{4,i,t}$, $D_{6,i,t}$, $D_{7,i,t}$, $D_{8,i,t}$) are zero. Notice that the binary variables that indicate vertical integration into retail ($D_{3,i,t}$) and vertical integration into production ($D_{9,i,t}$) do not apply for retail firms.

Yum Brands (owner of KFC, Taco Bell, Pizza Hut, Long John Silver's and A&W restaurants) is an example of a single segment restaurant firm. So, in the case of Yum Brands, the binary variable for single segment firms ($D_{8,i,t}$) is a one and all of the other binary variables ($D_{1,i,t}$, $D_{2,i,t}$, $D_{3,i,t}$, $D_{5,i,t}$, $D_{6,i,t}$, $D_{7,i,t}$) are zero. Notice that the binary variables that indicate vertical integration into restaurants ($D_{4,i,t}$) and vertical integration into production ($D_{9,i,t}$) do not apply for restaurant firms.

Table 3.6 Variable Definitions

Symbol	Variable	Definition
$EV_{i,t}$	Excess Value	Excess value
$X_{1,i,t}$	Ln(Assets)	Natural log of total assets for firm *i* in year *t*
$X_{2,i,t}$	Profitability	EBIT divided by sales for firm *i* in year *t*
$X_{3,i,t}$	Growth	Capital expenditures divided by sales for firm *i* in year *t*
$X_{4,i,t}$	Leverage	Debt to asset ratio for firm *i* in year *t*
$X_{5,i,t}$	Ln(Assets)^2	Natural log of total assets squared for firm *i* in year *t*
$X_{6,i,t}$	Family control	Binary variable that equals one if firm *i* is family-controlled in year *t* and 0 otherwise
$D_{1,i,t}$	Vertical integration - processing	Binary variable that equals one if firm *i* is vertically integrated into processing in year *t* and 0 otherwise
$D_{2,i,t}$	Vertical integration - wholesale	Binary variable that equals one if firm *i* is vertically integrated into wholesale in year *t* and 0 otherwise
$D_{3,i,t}$	Vertical integration - retail	Binary variable that equals one if firm *i* is vertically integrated into retail in year *t* and 0 otherwise
$D_{4,i,t}$	Vertical integration - restaurant	Binary variable that equals one if firm *i* is vertically integrated into restaurants in year *t* and 0 otherwise
$D_{5,i,t}$	Unrelated diversification	Binary variable that equals one if firm *i* is diversified into unrelated activities in year *t* and 0 otherwise
$D_{6,i,t}$	Horizontal integration	Binary variable that equals one if firm *i* is horizontally integrated in year *t* and 0 otherwise
$D_{7,i,t}$	Unrelated diversification and horizontal integration	Binary variable that equals one if firm *i* is diversified into unrelated activities and horizontally integrated in year *t* and 0 otherwise
$D_{8,i,t}$	Single segment firms	Binary variable that equals one if firm *i* is a single segment firm in year *t* and 0 otherwise
$D_{9,i,t}$	Vertical Integration - production[a]	Binary variable that equals one if firm *i* is vertically integrated into production in year *t* and 0 otherwise

[a]This variable only applies to processing firms.

3.2.2 Endogenous Integration and Diversification Model

As discussed by Campa and Kedia (2002) and Laeven and Levine (2005), certain firm and industry effects may both lead a firm to diversify or integrate and affect firm value. In other words, as stated by Campa and Kedia (2002), "firms that choose to diversify [or integrate] are not a random sample of firms." (p.1747) In this case, $D_{i,t}$ and $\varepsilon_{i,t}$ in equation (5) might be correlated. This would incorrectly attribute a discount or premium to the diversification or integration itself and not the underlying firm characteristics that caused the firm to pursue such a strategy. To account for these underlying firm and industry characteristics, diversification and integration are endogenous in the following model and Heckman's (1979) two-stage procedure is used to control for the self-selection of firms that diversify.[15] As is done by Campa and Kedia (2002), in the first step, probit models of firm's diversification and integration decisions are estimated as a function of firm effects in the following form

(6) $$D_{i,t}^{*} = \delta X_{i,t} + \mu_{i,t}$$

(7) $$D_{i,t} = 1 \text{ if } D_{i,t}^{*} > 0$$

(8) $$D_{i,t} = 0 \text{ if } D_{i,t}^{*} \leq 0$$

where $D_{i,t}^{*}$ is an unobserved latent variable, $X_{i,t}$ is a vector of firm characteristics that may affect the decision to pursue a diversification or integration strategy, δ is a vector of parameters to be estimated, and $\mu_{i,t}$ is the error term. Assume that $\varepsilon_{i,t}$ from (5) and $\mu_{i,t}$ from (6) have a bivariate normal distribution with means zero, standard deviation σ_e, and correlation ρ. Therefore, the expected excess value conditional on the firm being diversified or integrated can be estimated as

(9) $$E(EV_{i,t}|D_{i,t} = 1) = \alpha + \delta X_{i,t} + \beta + E(\varepsilon_{i,t}|D_{i,t} = 1)$$

---

[15] The use of instrumental variables is another way to test for endogeneity. However, examination of the available Compustat data revealed no instrumental variables that are thought to be highly correlated with diversification and integration. Thus, instrumental variables are not used in this analysis.

where

(10) $$E(\varepsilon_{i,t}|D_{i,t} = 1) = \rho\sigma_e\lambda_1(\delta X_{i,t})$$

and

(11) $$\lambda_1(\delta X_{i,t}) = \frac{\phi(\delta X_{i,t})}{\Phi(\delta X_{i,t})}$$

where $\phi(.)$ and $\Phi(.)$ are the standard normal density and cumulative density functions, respectively. The expected excess value conditional on the firm not being diversified or integrated can be estimated as

(12) $$E(EV_{i,t}|D_{i,t} = 0) = \alpha + \delta X_{i,t} + \beta + E(\varepsilon_{i,t}|D_{i,t}=0)$$

where

(13) $$E(\varepsilon_{i,t}|D_{i,t} = 0) = \rho\sigma_e\lambda_2(\delta X_{i,t})$$

and

(14) $$\lambda_2(\delta X_{i,t}) = \frac{-\phi(\delta X_{i,t})}{1-\Phi(\delta X_{i,t})}$$

Therefore the difference between the value of single segment and diversified or integrated firms is

(15) $$E(EV_{i,t}|D_{i,t} = 1) - E(EV_{i,t}|D_{i,t} = 0) = \beta + \rho\sigma_e \frac{\phi(\delta X_{i,t})}{\Phi(\delta X_{i,t})(1-\Phi(\delta X_{i,t}))}$$

The estimates of δ from the first step probit model are used to estimate λ_1 and λ_2 for use in the following OLS model which becomes the second stage of the regression procedure

(16) $$EV_{i,t} = \alpha + \beta D_{i,t} + \gamma X_{i,t} + \varsigma[\lambda_1(\hat{\delta} X_{i,t}) * D_{i,t} + \lambda_2(\hat{\delta} X_{i,t}) * (1-D_{i,t})] + \eta_{i,t}$$

$$= \alpha + \beta D_{i,t} + \gamma X_{i,t} + \varsigma\lambda + \eta_{i,t}$$

where $\varsigma = \rho\sigma_e$. The right hand side of equation (15) is the ordinary least squares coefficient, β, which will be biased downward (upward) if $\varepsilon_{i,t}$ from (5) and $\mu_{i,t}$ from (6) are negatively (positively) correlated. This correlation, ρ, then determines the sign of ς. The variable, λ, is commonly referred to as the self-selection parameter because it indicates whether diversified or integrated firms are a random sample or if this strategic decision is correlated with the firm effects in equation (5) (Campa and Kedia 2002).

3.3 Data

The data used in this study are taken from Standard and Poor's Compustat database and include data from 416 food business firms from 1983 to 2005. The data are unique in that they include financial information for the individual business segments as well as the firm as a whole. The availability of segment data as well as the wide range of available years of data is the primary reason for using Compustat as opposed to other data sources discussed in the previous chapter. As mentioned previously, the segment information includes net sales, assets, EBIT, depreciation, and capital expenditures. Segment data information was first collected by Compustat in 1983 which is why 1983 is the earliest year used in this study. This data has been used in previous research on the food economy by Schumacher and Boland (2005) and Boland, Golden, and Tsoodle (2006) and in previous research on the whole U.S. economy by Berger and Ofek (1995) and Campa and Kedia (2002). Table 3.7 provides means, medians, and standard deviations for the independent variables in equation (5) as well as the number of segments.

Table 3.7 Mean, Median, and Standard Deviation of Firm Characteristics for Each Type of Food Economy Firm

	Processing			Wholesale			Retail			Restaurant		
	Mean	**Med.**[a]	**SD**[b]	**Mean**	**Med.**	**SD**	**Mean**	**Med.**	**SD**	**Mean**	**Med.**	**SD**
Natural Log of Assets												
Single-segment firms	19.086	19.022	2.338	17.929	17.829	2.518	20.373	20.378	1.678	18.060	18.014	2.004
Multi-segment firms	20.844	21.226	2.363	19.974	20.362	1.800	21.099	20.792	1.484	18.833	19.089	1.575
EBIT to Sales Ratio												
Single-segment firms	0.065	0.070	0.105	-0.010	0.023	0.123	0.027	0.029	0.024	0.037	0.050	0.098
Multi-segment firms	0.083	0.085	0.071	0.004	0.021	0.079	0.028	0.033	0.017	0.059	0.059	0.059
Capital Expenditures to Sales Ratio												
Single-segment firms	0.063	0.042	0.080	0.028	0.014	0.050	0.034	0.027	0.034	0.106	0.081	0.116
Multi-segment firms	0.053	0.044	0.046	0.033	0.015	0.129	0.034	0.032	0.017	0.063	0.054	0.038
Debt to Asset Ratio												
Single-segment firms	0.263	0.247	0.215	0.286	0.251	0.250	0.301	0.282	0.225	0.320	0.252	0.402
Multi-segment firms	0.272	0.258	0.165	0.318	0.311	0.132	0.335	0.323	0.167	0.299	0.217	0.287
Number of Segments												
Single-segment firms	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000
Multi-segment firms	2.766	2.000	0.979	2.274	2.000	0.468	2.352	2.000	0.635	2.247	2.000	0.503

[a]Med. denotes median.
[b]SD denotes standard deviation.

3.4 Empirical Model

This section describes the econometric procedures used to estimate the conceptual models developed in the previous section.

3.4.1 Exogenous Integration and Diversification Model

The conceptual model discussed in section 3.2.1 above was estimated in SAS® using PROC SYSLIN. The model is estimated in the following form for each of the four food economy sectors using seemingly unrelated regression (SUR):

(17) $$EV_{i,t} = \alpha + \beta_1 D_{1,i,t} + \beta_2 D_{2,i,t} + \beta_3 D_{3,i,t} + \beta_4 D_{4,i,t} + \beta_5 D_{5,i,t} + \beta_6 D_{6,i,t} + \beta_7 D_{7,i,t} + \beta_9 D_{9,i,t} + \gamma_1 X_{1,i,t} + \gamma_2 X_{2,i,t} + \gamma_3 X_{3,i,t} + \gamma_4 X_{4,i,t} + \gamma_5 X_{5,i,t} + \gamma_6 X_{6,i,t} + \varepsilon_{i,t}$$

where α, β, and γ are parameters to be estimated and ε is the error term. All the variables in equation (17) are defined in Table 3.6.[16] $D_{8,i,t}$ is used as the default variable for the diversification and integration dummy variables. The SUR methodology is used to account for any correlation that may exist among the error terms in the regression equations for the four food economy firm sectors.[17]

3.4.2 Endogenous Integration and Diversification Model

As discussed in the previous section, the second model uses Heckman's two stage procedure to control for self selection. LIMDEP contains a program for this procedure so it was utilized in the estimation of the following model. The probit model in the first stage is estimated as

(19) $$D_{i,t} = \alpha + \delta_1 X_{1,i,t} + \delta_2 X_{2,i,t} + \delta_3 X_{3,i,t} + \delta_4 X_{4,i,t} + \delta_5 X_{5,i,t} + \delta_6 X_{6,i,t} + \mu_{i,t}$$

[16] Equation (9) was also estimated with a time trend and time trend squared variable and the results are reported in Appendix E. The results are very similar.

[17] SUR results are reported in Chapter 4 but the ordinary least squares (OLS) results are virtually identical, suggesting that there is little or no correlation among the error terms.

where α and δ are parameters to be estimated, μ is the error term and all variables are as defined in Table 3.6.

The second stage uses the results from the probit model in an OLS estimation procedure on the following model

(20) $$EV_{i,t} = \alpha + \beta D_{i,t} + \gamma_1 X_{1,i,t} + \gamma_2 X_{2,i,t} + \gamma_3 X_{3,i,t} + \gamma_4 X_{4,i,t} + \gamma_5 X_{5,i,t} + \gamma_6 X_{6,i,t} + \varsigma\lambda + \eta_{i,t}$$

where $D_{i,t}$ is the binary variable used as the dependent variable in the first stage probit model and λ is the self-selection variable. All $X_{i,t}$ variables are as previously defined, α, β, γ, and ς are parameters to be estimated and η is the error term.

Notice that $D_{i,t}$ stays in the second stage although it is the dependent variable in the first stage. This is due to the fact that this variable is a "treatment effect". Treatment effects must be included in situations in which an individual chooses whether or not they receive a treatment (see Greene, 2003, pg. 788). In this case, this refers to a firm choosing whether or not they are diversified or integrated sometimes based on the firm effect variables included in equation (20). This also means that the entire sample must be used in the second stage and not just those observations for which the selection variable (in this case the binary variables that indicate diversification or integration) is equal to one (see Greene, 1998, pg. 716)

Both the first and second stages of Heckman's two step procedure described above are estimated using each binary variable for each food economy sector separately. For example, in one case, the above model uses the binary variable that indicates vertical integration into processing ($D_{1,i,t}$) for restaurant firms as the dependent variable in the first stage probit model and the lambdas calculated from these results in the second stage. Similarly, the binary variable for vertical integration into retail ($D_{3,i,t}$) for wholesale firms is used as the dependent variable in the first stage probit model and the lambdas calculated from these result are used in the second stage. This is done until each combination of sector and binary variable is used in Heckman's two step procedure.

CHAPTER 4 - RESULTS

The following sections give the results of the analysis described in the previous chapter. The first section discusses the results from the exogenous integration and diversification model, the second section discusses the results from the endogenous integration and diversification model, and the last section summarizes the results from both models.

4.1 Exogenous Integration and Diversification Model Results

Exogeneity assumes that the independent binary variables for diversification and integration are not influenced by the other independent variables. This suggests, for example, that positive coefficients on the binary variables in the model would lead to increases in excess value. The coefficients from the estimation of the model with exogenous diversification are shown in Table 4.1 along with the weighted R^2 for the system of equations. Standard errors are in parentheses. The weighted R^2 values are 0.3889 and 0.4477 for the asset and sales multipliers, respectively. These values are greater than those found by other authors. Campa and Kedia (2002) found R^2 values of 0.09 and 0.13 for their base OLS models using the asset and sales multipliers, respectively. Berger and Ofek (1995) found R^2 values of 0.086 and 0.114 for their base OLS models using the asset and sales multipliers, respectively. The higher R^2 values in this study are higher is likely due to the fact that the data is focused on the food economy rather than a broad panel of all firms in the economy.

Notice in Table 4.1 that every binary variable does not appear in every model. One reason this occurs is because every diversification and integration binary variable does not apply to every sector. For example, a retail firm cannot vertically integrate into retail. Also, some binary variable categories contain no observations for a particular sector. For example, no wholesale firms are vertically integrated into the restaurant sector in the data.

4.1.1 Firm Effects

In every sector except the wholesale sector, the coefficient on log of assets ($X_{1,i,t}$) is negatively and significantly related to excess value and the coefficient on log of assets squared ($X_{5,i,t}$) is positive and significant in all but one case (excluding wholesale). But, the two coefficients have to be considered jointly to determine the total effect of log of assets on the dependent variable. For example, a one unit increase in the log of assets increases excess value by 0.0041 percent for food processing firms using the asset multiplier. [18] Also, a one unit increase in the log of assets increases excess value by 0.3509 percent for retail firms using the sales multiplier. This indicates that asset size has a positive effect on firm value, which is what is expected.

With the exception of the wholesale sector (asset and sales multiplier), the coefficients on the variables for profitability ($X_{2,i,t}$) and growth ($X_{3,i,t}$) are positively related to firm value, which is what is expected. For example, for a one unit increase in EBIT over sales ($X_{2,i,t}$), excess value using the sales multiplier increases by 0.0416 percent for restaurant firms.[19] A one unit increase in capital expenditures over sales ($X_{3,i,t}$) increases excess value using the asset multiplier by 0.0185 percent for processing firms. Capital expenditures over sales includes new assets which would presumably increase profitability and lead to an increase in firm value. An increase in

---

[18] Note that, when taking the derivative, the interpretation is in terms of V/IV and not ln(V/IV). For example, since the mean of the natural log of assets is 19.5124 for firms in the processing sector the total effect of the natural log of assets on excess value can be found as follows:

$\ln(V/IV)=\gamma_1 \ln(\text{Assets}) + \gamma_5 \ln(\text{Assets})^2$

$\partial \ln(V/IV) / \partial \ln(\text{Assets}) = \% \Delta (V/IV) / \% \Delta \text{Assets} = \gamma_1 + 2\gamma_5 \ln(\text{Assets})=-0.0193 + 2*0.0006*19.5124=0.0041.$

[19] Because the dependent variable is logged, the coefficients must be multiplied by the mean value for interpretation. For example, since the mean of EBIT over sales for firms in the restaurant sector is 1.0700 the effect of EBIT over sales on excess value can be found as follows:

$\ln(V/IV)=\gamma_2(\text{EBIT/sales})$

$\partial \ln(V/IV)/(\partial (\text{EBIT/sales})/(\text{EBIT/sales}))=\gamma_2 * (\text{EBIT/sales}) = 0.0388 * 1.0700 = 0.0416.$

EBIT over sales is indicative of an increase in profitability which would lead to an increase in firm value. Campa and Kedia (2002) and Berger and Ofek (1995) also found positive and significant coefficients for EBIT over sales and capital expenditures over sales.

The coefficient on debt to asset ratio ($X_{4,i,t}$) is positive and significant in the restaurant sector and in the wholesale sector when the asset multiplier is used. The coefficient on debt to asset ratio ($X_{4,i,t}$) is negative and significant in the retail sector. For example, a one unit increase in the debt to asset ratio increases excess value using the sales multiplier by 0.0427 percent for restaurant firms and decreases excess value using the asset multiplier by 0.0411 percent for retail firms. Leverage is usually thought to have a negative effect on firm value but large restaurant chains that carry a large amount of debt due to the specialized buildings and equipment that are needed may not be valued lower because they are highly leveraged.

Notice that $X_{6,i,t}$, the variable for family control, is positive and significant in every equation which supports the finding by Anderson and Reeb (2003) that family control increases firm value. As discussed by Halvorsen and Palmquist (1980) and Kennedy (1981) adjustment is necessary when interpreting dummy variables in equations with logged dependent variables. The third values for $X_{6,i,t}$ in Table 4.1 show the adjusted coefficients for $X_{6,i,t}$ for each sector and multiplier. The following formula from Kennedy (1981) is used for the adjustment

(21)
$$g^* = \exp\left(\hat{c} - \frac{1}{2}\hat{V}(\hat{c})\right) - 1$$

where $\hat{c}$ is the estimated coefficient, $\hat{V}(\hat{c})$ is the variance of $\hat{c}$ and g^* is the adjusted value.

Table 4.1 indicates that a firm being family-controlled increases excess value using the asset multiplier by 23.69 percent for processing firms. And, a firm being family-controlled increases excess value using the sales multiplier by 10.76 percent for retail firms.

4.1.2 Integration and Diversification Effects

Because the dummy variable for single segment firms is used as the default variable in the SUR estimation, all of the interpretations are in relation to this variable. Therefore, in Table 4.2, the regression coefficients are used to find a discount or premium using the mean value for single segment firms in each of the sectors and for each of the multipliers. The shaded discounts and premiums are calculated from regression coefficients that are significant at the 10 percent level. The regression coefficients are the increases or decreases in excess value relative to the mean excess value for single segment firms. So, to find the actual discount or premium, the regression coefficient is multiplied by the mean for single segment firms and this value is added to the mean. For example, for processing firms, the 0.06 percent discount for vertical integration into wholesale ($D_{2,i,t}$) using the sales multiplier is calculated as follows: 0.0158 + (0.0158*(-0.9645)) = 0.00056*100 = 0.06 percent where 0.0158 is the mean excess value for single segment processing firms using the sales multiplier and -0.9645 is the regression coefficient on ($D_{2,i,t}$) from Table 4.1. In the model using the asset multiplier, vertical integration into the wholesale sector ($D_{2,i,t}$) results in a 0.73 percent premium for processing firms (Table 4.2). This indicates that processing firms that are integrated into the wholesale sector are valued higher than single segment processing firms, holding all other variables constant. The same is true for every binary variable in every case in the processing sector where the largest premium is for unrelated diversification ($D_{5,i,t}$) using both multipliers and the smallest premiums are for unrelated diversification and horizontal integration pursued jointly ($D_{7,i,t}$).

The results indicate that discounts are associated with every diversification and integration strategy in the wholesale sector using both the asset and sales multipliers except for vertical integration into processing ($D_{5,i,t}$) which results in a premium using both multipliers and vertical integration into retail ($D_{3,i,t}$) using the sales multiplier which also results in a premium. The largest discounts in the wholesale sector are for unrelated diversification ($D_{5,i,t}$). In the retail sector, in the model using the asset multiplier, horizontal integration ($D_{6,i,t}$) results in a 3.08 percent premium. This indicates that retail firms that are horizontally integrated are valued higher than single segment retail firms, holding all other variables constant. In the restaurant sector, in the model using the sales multiplier, vertical integration into the processing sector ($D_{1,i,t}$) results in a 1.56 percent premium. This indicates that restaurant firms that are integrated into the processing sector are valued higher than single segment restaurant firms, holding all other variables constant. The largest premiums in the restaurant sector are for unrelated diversification ($D_{5,i,t}$).

Overall, the results from the models with exogenous integration and diversification variables indicate that, in most cases, diversified and integrated firms are valued at a premium relative to single segment firms, with variation between sectors and multipliers used. The hypothesis tests are done at the 10 percent level of significance by testing the significance of the parameter estimate for that variable. Thus, the hypothesis that integration leads to a premium for food economy firms cannot be rejected for the restaurant sector and for the processing sector except in the case of vertical integration into retail ($D_{3,i,t}$) in the processing sector. The hypothesis that integration leads to a premium for food economy firms also cannot be rejected in the wholesale sector for vertical integration into processing ($D_{1,i,t}$) using both multipliers and vertical integration into retail ($D_{3,i,t}$) using the sales multiplier. The hypothesis that integration leads to a premium for food economy firms also cannot be rejected in the retail sector for vertical integration into processing using the asset multiplier ($D_{1,i,t}$), vertical integration into wholesale using the sales multiplier ($D_{2,i,t}$), and horizontal integration using the asset multiplier ($D_{6,i,t}$). The hypothesis that diversification leads to a discount for food economy firms is not rejected for the wholesale sector using the asset multiplier and for the retail sector using the sales multiplier because a discount is found for unrelated diversification ($D_{5,i,t}$) in these cases.

To further investigate the hypotheses, it is important to determine if diversification and integration decisions should be considered endogenous instead of exogenous. In other words, the diversification and integration decisions may not be independent of the firm effects. Therefore, the results of the endogeneity tests are discussed in the next section.

Table 4.1 Seemingly Unrelated Regression Results for Food Economy Firms by Sector and Multiplier

	Processing		Wholesale		Retail		Restaurant	
	Asset multiplier	**Sales Multiplier**	**Asset multiplier**	**Sales Multiplier**	**Asset multiplier**	**Sales Multiplier**	**Asset multiplier**	**Sales Multiplier**
Intercept	0.0022	0.0017	0.0002	0.0001	0.0000	0.0000	0.0008	0.0006
	(0.0086)	(0.0095)	(0.0028)	(0.0037)	(0.0025)	(0.0030)	(0.0067)	(0.0074)
$X_{1,i,t}$	-0.0193***	-0.0532***	0.0101	0.0137*	-0.0675***	-0.0960***	-0.0054	-0.1237***
	(0.0043)	(0.0048)	(0.0063)	(0.0081)	(0.0045)	(0.0053)	(0.0055)	(0.0060)
$X_{2,i,t}$	1.4859***	1.6122***	-1.2972***	-0.7750***	12.2051***	15.5805***	1.9621***	1.0700***
	(0.1041)	(0.1151)	(0.1230)	(0.1585)	(0.3383)	(0.3998)	(0.1150)	(0.1265)
$X_{3,i,t}$	0.3048**	2.0369***	0.0457	3.0647***	-0.2016	4.5686***	1.5702***	2.8617***
	(0.1233)	(0.1364)	(0.1301)	(0.1677)	(0.2218)	(0.2620)	(0.0826)	(0.0909)
$X_{4,i,t}$	-0.0287	0.0070	0.5016***	-0.0588	-0.1342***	-0.1514***	0.2002***	0.1338***
	(0.0450)	(0.0498)	(0.0559)	(0.0721)	(0.0347)	(0.0410)	(0.0238)	(0.0262)
$X_{5,i,t}$	0.0006***	0.0020***	-0.0011***	-0.0016***	0.0027***	0.0032***	-0.0005*	0.0057***
	(0.0002)	(0.0002)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
$X_{6,i,t}$[a]	0.2234***	0.1390***	0.2140***	0.2248**	0.1945***	0.1131***	0.2590***	0.1980***
	(0.0215)	(0.0238)	(0.0746)	(0.0962)	(0.0183)	(0.0216)	(0.0512	(0.0563)
	23.69	13.55	19.33	19.33	20.36	10.76	26.29)	18.52
$D_{1,i,t}$			-1.0584***	-1.3672***	-0.7319***	-0.9027***	-0.5825***	-0.5907***
	n/a[b]	n/a	(0.0400)	(0.0516)	(0.0419)	(0.0496)	(0.0559)	(0.0615)
$D_{2,i,t}$	-0.8303***	-0.9645***			-1.1601***	-1.2258***	-0.9353***	-0.7907***
	(0.0768)	(0.0850)	n/a	n/a	(0.0324)	(0.0383)	(0.0801)	(0.0882)
$D_{3,i,t}$	-0.2094	-0.0823	-0.9171***	-1.1156***				
	(0.1770)	(0.1958)	(0.0317)	(0.0408)	n/a	n/a	n/a	n/a
$D_{4,i,t}$	-0.7567***	-0.7227***						
	(0.0536)	(0.0594)	n/a	n/a	n/a	n/a	n/a	n/a
$D_{5,i,t}$	-0.0684	-0.0642	-0.3246***	-0.0671	-0.5291***	-0.5057***	-0.5798***	-0.4655***
	(0.0429)	(0.0475)	(0.0510)	(0.0657)	(0.0289)	(0.0341)	(0.0603)	(0.0664)
$D_{6,i,t}$	-0.8053***	-0.7474***	-0.3640***	-0.7555***	-0.6123***	-0.5182***		
	(0.0300)	(0.0332)	(0.0584)	(0.0752)	(0.1524)	(0.1801)	n/a	n/a
$D_{7,i,t}$	-0.9893***	-0.9422***						
	(0.0574)	(0.0635)	n/a	n/a	n/a	n/a	n/a	n/a
$D_{9,i,t}$	-0.4529***	-0.7538***						
	(0.0820)	(0.0907)	n/a	n/a	n/a	n/a	n/a	n/a
System Weighted R^2	0.3889	0.4477						

[a]The third values in this row are the adjusted parameter estimates found using equation (21).
[b]n/a denotes not applicable, ***significant at the 1% level, **significant at the 5% level, *significant at the 10% level.

Table 4.2 Calculated Premiums and Discounts from Seemingly Unrelated Regression Results

	Processing		Wholesale		Retail		Restaurant	
	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier
Single Segment Mean	4.29%	1.58%	-0.95%	-20.18%	7.95%	-6.40%	5.78%	3.81%
$D_{1,i,t}$	n/a[a]	n/a	0.06%[b]	7.41%	2.13%	-0.62%	2.41%	1.56%
$D_{2,i,t}$	0.73%[c]	0.06%	n/a	n/a	-1.27%	1.45%	0.37%	0.80%
$D_{3,i,t}$	3.39%	1.45%	-0.08%	2.33%	n/a	n/a	n/a	n/a
$D_{4,i,t}$	1.04%	0.44%	n/a	n/a	n/a	n/a	n/a	n/a
$D_{5,i,t}$	4.00%	1.48%	-0.64%	-18.83%	3.74%	-3.16%	2.43%	2.04%
$D_{6,i,t}$	0.84%	0.40%	-0.60%	-4.93%	3.08%	-3.08%	n/a	n/a
$D_{7,i,t}$	0.05%	0.09%	n/a	n/a	n/a	n/a	n/a	n/a
$D_{9,i,t}$	2.35%	0.39%	n/a	n/a	n/a	n/a	n/a	n/a

[a]n/a denotes not applicable.

[b]The regression coefficients from Table 4.1 are multiplied by the mean for single segment firms and this value is added to the mean to find the actual discount or premium in every case. For example, for processing firms, the 3.1 percent discount for vertical integration into wholesale ($D_{2,i,t}$) using the sales multiplier is calculated as follows: 0.0158+(0.0158*-0.9645) = 0.00056*100 = 0.06% where 0.0158 is the mean excess value for single segment processing firms using the sales multiplier and -0.9645 is the regression coefficient on ($D_{2,i,t}$) from Table 4.1.

[c]Shaded cells indicate that the discount or premium is calculated from a regression coefficient that is significant at the 10 percent level.

4.2 Endogenous Integration and Diversification Model Results

Recall that Heckman's two step procedure was used to test the endogeneity of the diversification or integration decision. Tables 4.3 to 4.8 provide the results of the second stage of this procedure for each food economy sector along with the adjusted R^2 for each model. The probit results from the first stage are reported in Appendix F since their purpose is to calculate lambda and not to show a causal relationship. Recall that both the first and second stage of Heckman's two step procedure is performed for each binary variable and then the binary variable that is the dependent variable in the first stage is also included as a "treatment effect" in the second stage, along with the self-selection parameter, λ. The rows in Tables 4.3 to 4.8 that are labeled $D_{i,t}$ provide the coefficient and standard error for the binary variable that is left in the model. Each column heading indicates the specific binary variable in the model. If the coefficient on lambda is significant, it indicates that diversification or integration decision is endogenous and the sign indicates whether the relationship between firm value and the factors that influence diversification and integration is positive or negative.

Table 4.9 summarizes the endogeneity tests from each of the models. If a cell contains n/a, the variable did not occur in that particular model. If the cell is empty, lambda is not significantly different from zero in that model. And, the cells with positive and negative signs indicate the signs of the significant lambdas.

Each subsection below provides the results from a specific sector of the food economy. Then, Section 4.3 compares and summarizes the results from the previous section where integration and diversification are exogenous and the current section on endogeneity.

4.2.1 Processing Sector

As a general rule, the signs and significance of the firm effect ($X_{i,t}$) variables do not change much with each binary variable used for processing sector firms as compared to the results from SUR, although the magnitudes do change in some cases. The magnitudes of the coefficients are similar across each equation with the each of the binary variables.

Four of the eight lambda coefficients are significant at the 10 percent level in the models using the asset multiplier (Table 4.3) and four are significant using the sales multiplier (Table 4.4). The coefficients on lambda in the models that include the binary variable for vertical integration into wholesale ($D_{2,i,t}$) using both the asset and sales multiplier are positive and significant (e.g., 1.3482 and 1.3149 for the asset and sales multipliers, respectively) indicating that the characteristics that make firms choose to vertically integrate into wholesale are positively correlated with firm value. The coefficients on lambda in the models with the asset multiplier and unrelated diversification ($D_{5,i,t}$), unrelated diversification with horizontal integration ($D_{7,i,t}$) and vertical integration into production ($D_{9,i,t}$) are negative and significant. The coefficients on lambda in the models with the sales multiplier and vertical integration into restaurants ($D_{4,i,t}$), unrelated diversification ($D_{5,i,t}$) and single segment firms ($D_{8,i,t}$) are negative and significant.

Recall that, using SUR, there was a premium for every diversification and integration strategy in the processing sector. But, in Table 4.3, the premium[20] for vertical integration into wholesale ($D_{2,i,t}$) turns negative in the models using the asset multiplier. For example, in Table 4.2 there is a premium for vertical integration into wholesale ($D_{2,i,t}$) using the asset multiplier, but in Table 4.3 the coefficient for vertical integration into wholesale ($D_{2,i,t}$) is negative. The

[20] Recall that this premium can be found in the row labeled $D_{i,t}$.

premium turns negative for vertical integration into wholesale ($D_{2,i,t}$) when the sales multiplier is used as well (Table 4.4).

4.2.2 Wholesale Sector

In the wholesale sector, two of the five lambda coefficients are significant in the model using the sales multiplier (Table 4.5) and three of the five lambda coefficients are significant in the model using the asset multiplier (Table 4.6). The coefficients on lambda in the models that include the binary variable for horizontal integration ($D_{6,i,t}$) using both the asset and sales multiplier are negative and significant indicating that the characteristics that make firms choose to horizontally integrate are negatively correlated with firm value.

The coefficient on lambda in the model that includes the binary variable for vertical integration into processing ($D_{1,i,t}$) using the sales multiplier is positive and significant indicating that the characteristics that make wholesale firms choose to vertically integrate into processing are positively correlated with firm value. The lambda coefficient in the model that includes the binary variable for vertical integration into retail ($D_{3,i,t}$) using the asset multiplier is positive and significant indicating that the characteristics that make wholesale firms choose to vertically integrate into retail are positively correlated with firm value. The coefficient on lambda in the model that includes the binary variable for single segment firms ($D_{8,i,t}$) using the sales multiplier is negative and significant indicating that the characteristics that make wholesale firms choose to be single segment firms are negatively correlated with firm value.

The magnitudes, signs, and significance of the firm effect ($X_{i,t}$) variables change with all binary variable used for wholesale sector firms as compared to the results from SUR. But notice that these results are also not consistent across the models that include different binary variables. The discount for horizontal integration ($D_{6,i,t}$) found using SUR turns positive in the model using the asset and sales multiplier. For example, in Table 4.2 there is a discount for horizontal integration ($D_{6,i,t}$) using the sales multiplier for wholesale firms but in Table 4.6 the coefficient for horizontal integration ($D_{6,i,t}$) is positive.

4.2.3 Retail Sector

The coefficient on lambda in the models that include the binary variable for unrelated diversification ($D_{5,i,t}$) using both the asset and sales multiplier is negative and significant indicating that the characteristics that make firms choose to pursue unrelated diversification are negatively correlated with firm value (Table 4.7). The magnitudes, signs, and significance of the firm effect ($X_{i,t}$) variables change slightly with each binary variable used for retail sector firms as compared to the results from SUR.

4.2.4 Restaurant Sector

Six of the eight parameter estimates for lambda are significant at the ten percent level for the models using the sales and asset multipliers. The coefficients on lambda in the models that include the binary variable for vertical integration into wholesale ($D_{2,i,t}$) using both the asset and sales multipliers are positive and significant indicating that the characteristics that make restaurant firms choose to vertically integrate into wholesale are positively correlated with firm value. The coefficients on the firm effect ($X_{i,t}$) variables change slightly with each binary variable used for restaurant sector firms as compared to the results from SUR (Table 4.8).

The coefficients on lambda in the models that include the binary variable for vertical integration into processing ($D_{1,i,t}$) using both the asset and sales multipliers are negative and significant indicating that the characteristics that make restaurant firms choose to vertically integrate into processing are negatively correlated with firm value. Also, the parameter estimates on lambda in the models that include the binary variable for unrelated diversification ($D_{5,i,t}$) using both the asset and sales multipliers are positive and significant indicating that the characteristics that make restaurant firms choose to pursue unrelated diversification are positively correlated with firm value.

In Table 4.8, the premiums for vertical integration into wholesale ($D_{2,i,t}$) and unrelated diversification ($D_{5,i,t}$) turn negative in the models using the asset and sales multipliers whereas in Table 4.2 these values were positive.

4.3 Summary of Results

Sorting through the results of the endogeneity tests is somewhat tedious, so the following sections summarize the results. The first subsection summarizes the results from the exogenous model, the second section summarizes the results from the endogenous model, and the last section provides some overall results.

4.3.1 Summary of Exogenous Model Results

The SUR results indicate that there is a premium for every diversification and integration strategy relative to single segment firms in the processing and restaurant sectors, except in the case of vertical integration into retail in the processing sector using both multipliers because these regression coefficients are insignificant. In the retail sector there is a premium in every case except vertical integration into wholesale using the asset multiplier and a discount in every case except vertical integration into wholesale using the sales multiplier. There is a discount in every case in the wholesale sector except for vertical integration into processing using both multipliers and vertical integration into retail using the sales multiplier. The SUR results also indicate that the ratio of capital expenditures to sales and the ratio of EBIT to sales positively influence excess value. A firm being family controlled has a positive impact on firm value as well.

4.3.2 Summary of Endogenous Model Results

If lambda is significant in the second stage of Heckman's two step procedure, this indicates that the specific diversification or integration strategy that is in the model is endogenous. This means that it is correlated with the firm characteristics that influence excess value. If lambda is negative (positive) this correlation is negative (positive) and coefficients on the binary variables in the SUR results are biased downward (upward). The strongest endogeneity indications are given by those cases in which the signs using the assets and sales multipliers are the same and the lambdas are both significant. These are the darker shaded cells in Table 4.9. The same can be said for the cases in which the lambdas for both the asset and sales multiplier are insignificant, indicating the binary diversification or integration decision is exogenously determined. These are the lighter shaded cells in Table 4.9.

4.3.2.1 Cases of Exogeneity

If the diversification or integration strategy is exogenous it suggests that the firm characteristics that influence excess value are not correlated with lambda. This indicates that the integration or diversification strategy is random in the sample. The results indicate that the integration or diversification decision is exogenous in the case of processing firms that vertically integrate into the retail sector ($D_{3,i,t}$), processing firms that horizontally integrate ($D_{6,i,t}$), wholesale firms that pursue unrelated diversification ($D_{5,i,t}$), and retail firms that vertically integrate into the processing ($D_{1,i,t}$) and wholesale sectors ($D_{2,i,t}$).

In the case where lambda is not significant using both multipliers, it can be assumed that the sign on the binary variables in the SUR results is correct. And, since all of the signs are positive on the binary variables in the SUR results in the processing and restaurant sectors and in the retail sector using the asset multiplier (except in the case of vertical integration into wholesale), the premiums remain when the diversification or integration decision is found to be exogenous in these cases.

4.3.2.2 Cases of Endogeneity

Recall that a significant lambda indicates endogeneity. When lambda is negative and significant, this means that when the firm characteristics that cause firms to diversify or integrate are negatively correlated with firm value, the discount turns to a premium. This may seem counterintuitive at first but recall that the data set includes firms that are diversifying or integrating and those that are not. When you control for firms that are choosing to diversify or integrate based on exogenous characteristics (that are negatively correlated with firm value), the effect of diversification or integration on firm value is actually positive for these firms. The results from Campa and Kedia (2002) also indicate a premium that was previously a discount and a negative lambda coefficient for diversification. When lambda is positive and significant, this means that when the firm characteristics that cause firms to diversify or integrate are positively correlated with firm value, the premium turns to a discount.

There is one case where, using both multipliers, the lambdas are negative and significant and the discounts from the SUR results become premiums. This is the case of wholesale firms that are pursuing horizontal integration. The results suggest that this type of horizontal integration strategy leads to a premium, on average. Thus, the hypothesis that a premium exists for food economy firms pursing integration cannot be rejected in the case of wholesale firms that are horizontally integrated.

Table 4.9 shows three cases in which characteristics that cause firms to diversify or integrate are positively correlated with firm value and the premiums from the SUR results turn to discounts using both multipliers. One of these cases is vertical integration into wholesale by processing firms. The results suggest that, on average, this decision may lead to a discount in this situation for this time period. Vertical integration into wholesale by restaurant firms is another case where lambda is positive. Ruby Tuesday is a restaurant firm that was vertically integrated into grocery wholesaling in the 1980s but divested itself of its wholesaling operations by the end of the 1990s. This indicates that management may have realized this type of activity was having a negative effect on firm value. Another case is unrelated diversification by restaurant firms. The results suggest that this type of activity is causing a discount during this time period, on average.

In all of these cases, the premiums turn to discounts that are statistically significant. This indicates that, when controlling for firms that are choosing to diversify or integrate based on exogenous characteristics (that are positively correlated with excess value), the effect of diversification or integration on firm value is actually negative.

Table 4.3 Results from the Second Stage of Heckman's Two-Step Procedure for Processing Firms Using the Asset Multiplier

	$D_{2,i,t}$	$D_{3,i,t}$	$D_{4,i,t}$	$D_{5,i,t}$	$D_{6,i,t}$	$D_{7,i,t}$	$D_{8,i,t}$	$D_{9,i,t}$
Intercept	6.4537***	6.7717***	6.6088***	7.6861***	7.1519***	6.5636***	7.0277***	6.4044***
	(1.0493)	(1.1479)	(0.9369)	(1.7076)	(0.9077)	(1.0278)	(0.7873)	(0.8552)
$D_{i,t}$	-4.0587**	9.5184	-0.0163	4.0533***	-0.4295	1.7794**	0.9849**	0.8826***
	(1.7939)	(6.8564)	(0.9758)	(1.0475)	(0.3553)	(0.7306)	(0.3976)	(0.6661)
$X_{1,i,t}$	-0.6579***	-0.6842***	-0.6730***	-0.7660***	-0.7385***	-0.6610***	-0.8499***	-0.6487***
	(0.1085)	(0.1185)	(0.0971)	(0.1774)	(0.0978)	(0.1064)	(0.1068)	(0.0886)
$X_{2,i,t}$	1.8079***	1.9373***	2.0045***	1.9290***	1.9794***	2.1176***	1.7832***	2.0616***
	(0.2281)	(0.2290)	(0.1854)	(0.3429)	(0.1616)	(0.2129)	(0.1806)	(0.1768)
$X_{3,i,t}$	0.3304	0.5291**	0.5085**	0.8505**	0.4332**	0.4744*	0.2832	0.5376***
	(0.2436)	(0.2609)	(0.2052)	(0.3850)	(0.1974)	(0.2497)	(0.2047)	(0.2025)
$X_{4,i,t}$	-0.0061	-0.0117	-0.0021	-0.0146	-0.0103	0.0642	-0.0845	-0.0095
	(0.0933)	(0.1029)	(0.0780)	(0.1507)	(0.0690)	(0.0919)	(0.0750)	(0.0739)
$X_{5,i,t}$	0.0157***	0.0160***	0.0159***	0.0172***	0.0180***	0.0152***	0.0220***	0.0152***
	(0.0028)	(0.0030)	(0.0025)	(0.0045)	(0.0027)	(0.0027)	(0.0032)	(0.0023)
$X_{6,i,t}$	0.3676***	0.3741***	0.3519***	0.3107***	0.3226***	0.3819***	0.2555***	0.3455***
	(0.0457)	(0.0486)	(0.0417)	(0.0753)	(0.0409)	(0.0439)	(0.0505)	(0.0354)
λ	1.3482*	-3.2936	-0.2592	-1.9243***	-0.1560	-1.1177***	-0.1853	-0.4740*
	(0.7034)	(2.3413)	(0.4249)	(0.5024)	(0.1886)	(0.3134)	(0.2302)	(0.2730)
Adj. R^2	0.1425	0.1359	0.1511	0.1410	0.2321	0.1660	0.2843	0.1309

***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Table 4.4 Results from the Second Stage of Heckman's Two-Step Procedure for Processing Firms Using the Sales Multiplier

	$D_{2,i,t}$	$D_{3,i,t}$	$D_{4,i,t}$	$D_{5,i,t}$	$D_{6,i,t}$	$D_{7,i,t}$	$D_{8,i,t}$	$D_{9,i,t}$
Intercept	4.6076***	4.9094***	4.1097***	5.5405***	5.6974***	4.7523***	5.5858***	4.7059***
	(1.0917)	(1.1388)	(1.0691)	(1.3974)	(1.0035)	(0.9106)	(1.0829)	(0.9215)
$D_{i,t}$	-4.1157**	8.4898	1.4343*	2.9262***	-0.7333*	0.2409	1.9140***	0.2310
	(1.7891)	(6.0557)	(0.7502)	(0.8223)	(0.3981)	(0.7924)	(0.4229)	(0.7947)
$X_{1,i,t}$	-0.5026***	-0.5278***	-0.4488***	-0.5848***	-0.6304***	-0.5156***	-0.8624***	-0.5109***
	(0.1128)	(0.1176)	(0.1104)	(0.1446)	(0.1082)	(0.0940)	(0.1339)	(0.0956)
$X_{2,i,t}$	1.8825***	2.0220***	2.1966***	2.0277***	2.0381***	2.0983***	1.6506***	2.0977***
	(0.2364)	(0.2285)	(0.2154)	(0.2812)	(0.1779)	(0.1922)	(0.2377)	(0.1911)
$X_{3,i,t}$	2.0522***	2.2510***	2.1499***	2.4794***	2.1050***	2.2274***	1.7959***	2.2397***
	(0.2562)	(0.2619)	(0.2491)	(0.3227)	(0.2176)	(0.2180)	(0.2726)	(0.2177)
$X_{4,i,t}$	0.0339	0.0294	0.0817	0.0290	0.0236	0.0473	-0.1227	0.0363
	(0.0967)	(0.1015)	(0.0912)	(0.1225)	(0.0760)	(0.0848)	(0.0999)	(0.0794)
$X_{5,i,t}$	0.0124***	0.0126***	0.0106***	0.0135***	0.0161***	0.0125***	0.0245***	0.0124***
	(0.0029)	(0.0030)	(0.0028)	(0.0037)	(0.0030)	(0.0024)	(0.0038)	(0.0025)
$X_{6,i,t}$	0.2643***	0.2682***	0.2835***	0.2187***	0.1981***	0.2528***	0.0607	0.2470***
	(0.0472)	(0.0481)	(0.0453)	(0.0604)	(0.0453)	(0.0401)	(0.0608)	(0.0381)
λ	1.3149*	-2.8952	-0.8765***	-1.4151***	0.0448	-0.4295	-0.7363***	-0.3280
	(0.7016)	(2.0680)	(0.3249)	(0.3940)	(0.2114)	(0.3420)	(0.2441)	(0.3272)
Adj. R^2	0.1511	0.1393	0.1523	0.1398	0.2047	0.1597	0.2604	0.1413

***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Table 4.5 Results from the Second Stage of Heckman's Two-Step Procedure for Wholesale Firms Using the Asset Multiplier

	$D_{1,i,t}$	$D_{3,i,t}$	$D_{5,i,t}$	$D_{6,i,t}$	$D_{8,i,t}$
Intercept	14.6492***	13.9302***	14.3842***	10.4672*	-6.1692
	(4.1683)	(4.0419)	(3.5327)	(6.0597)	(10.0042)
$D_{i,t}$	-0.1850	-2.2407***	-0.1978	4.9541**	3.3273**
	(0.8450)	(0.6980)	(0.6353)	(2.0191)	(1.3007)
$X_{1,i,t}$	-1.5205***	-1.5897***	-1.4875***	-1.0025	0.1924
	(0.4534)	(0.4397)	(0.3894)	(0.6691)	(0.9307)
$X_{2,i,t}$	0.0593	-0.5613	-0.0496	0.0074	-2.7989*
	(0.5979)	(0.7705)	(0.6891)	(0.9838)	(1.5752)
$X_{3,i,t}$	0.5032	0.1260	0.6239	0.5416	1.2788
	(0.5725)	(0.7085)	(0.6781)	(0.9130)	(1.0856)
$X_{4,i,t}$	0.3084	0.6624**	0.2917	0.7270*	0.7513
	(0.2551)	(0.3252)	(0.2485)	(0.4134)	(0.5037)
$X_{5,i,t}$	0.0374***	0.0443***	0.0364***	0.0210	0.0002**
	(0.0120)	(0.0120)	(0.0105)	(0.0183)	(0.0228)
$X_{6,i,t}$	0.3744				0.0787
	(0.4369)	n/a[a]	n/a	n/a	(0.6486)
λ	-0.2453	1.0124**	0.1923	-2.7207***	-1.6316
	(0.4677)	(0.4238)	(0.3613)	(1.0294)	(0.7883)
Adj. R^2	0.2440	0.3067	0.2035	0.3124	0.3579

[a]n/a denotes not applicable.
***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Table 4.6 Results from the Second Stage of Heckman's Two-Step Procedure for Wholesale Firms Using the Sales Multiplier

	$D_{1,i,t}$	$D_{3,i,t}$	$D_{5,i,t}$	$D_{6,i,t}$	$D_{8,i,t}$
Intercept	-0.2924	8.6411*	12.4847***	5.0675	-17.6041
	(6.4011)	(4.5425)	(4.7496)	(6.8406)	(12.8115)
$D_{i,t}$	-3.1693**	-1.9649**	1.3857*	4.9551**	4.2425**
	(1.2860)	(0.7986)	(0.8431)	(2.1809)	(1.6615)
$X_{1,i,t}$	0.1299	-0.9724**	-1.2903**	-0.3914	1.3084
	(0.6966)	(0.4927)	(0.5234)	(0.7540)	(1.1916)
$X_{2,i,t}$	-0.1190	-0.4812	0.7687	0.0121	-3.5900*
	(0.9286)	(0.8761)	(0.9256)	(1.1383)	(2.0137)
$X_{3,i,t}$	3.1348***	3.2597***	2.7892***	3.6281***	4.5631***
	(0.8863)	(0.8063)	(0.9098)	(1.0586)	(1.3879)
$X_{4,i,t}$	-0.0116	0.0159	-0.2423	0.1251	0.2793
	(0.3993)	(0.3686)	(0.3348)	(0.4791)	(0.6425)
$X_{5,i,t}$	-0.0073	0.0260*	0.0306**	0.0035	-0.0285
	(0.0185)	(0.0134)	(0.0142)	(0.0205)	(0.0292)
$X_{6,i,t}$	1.3062*				-0.0978
	(0.6905)	n/a[a]	n/a	n/a	(0.8256)
λ	1.2797*	0.7761	-0.6648	-2.8537**	-2.0687**
	(0.7015)	(0.4894)	(0.4723)	(1.1150)	(1.0067)
Adj. R^2	0.2902	0.2968	0.2391	0.2973	0.3729

[a]n/a denotes not applicable.
***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Table 4.7 Results from the Second Stage of Heckman's Two-Step Procedure for Retail Firms

	Asset Multiplier				Sales Multiplier			
	$D_{1,i,t}$	$D_{2,i,t}$	$D_{5,i,t}$	$D_{8,i,t}$	$D_{1,i,t}$	$D_{2,i,t}$	$D_{5,i,t}$	$D_{8,i,t}$
Intercept	-2.8666	1.5957	1.7638	-1.0360	-0.1120	2.5710	3.5369	6.6250
	(3.3528)	(2.9843)	(7.0577)	(3.8522)	(3.7808)	(3.4451)	(6.5735)	(7.9804)
$D_{i,t}$	-1.3510*	-1.5175***	2.9888*	0.0947	-0.6727	-1.0547	2.6256	-1.8434
	(0.7451)	(0.5605)	(1.7750)	(0.7684)	(0.8896)	(0.6712)	(1.6283)	(1.3884)
$X_{1,i,t}$	0.2480	-0.2373	-0.2075	0.0479	-0.0548	-0.3492	-0.4106	-0.5026
	(0.3308)	(0.2972)	(0.6934)	(0.3300)	(0.3733)	(0.3435)	(0.6454)	(0.7278)
$X_{2,i,t}$	14.0131***	11.6091***	14.9531***	12.7626***	16.7468***	15.3103***	18.0476***	17.3632***
	(1.3580)	(1.1708)	(2.7696)	(1.2557)	(1.5431)	(1.3551)	(2.5942)	(2.8864)
$X_{3,i,t}$	-0.2097	-0.2165	-0.4527	-0.1048	4.6682***	4.6407***	4.4295***	4.9364***
	(0.7888)	(0.7162)	(1.8188)	(0.7654)	(0.8824)	(0.8240)	(1.6752)	(1.7961)
$X_{4,i,t}$	-0.0629	-0.1089	0.1857	-0.2214*	-0.1906	-0.1906	0.0968	-0.3346
	(0.1495)	(0.1171)	(0.3141)	(0.1190)	(0.1712)	(0.1355)	(0.2998)	(0.2881)
$X_{5,i,t}$	-0.0062	0.0071	0.0043(0.01	-0.0009	0.0012	0.0092	0.0091	0.0106
	(0.0081)	(0.0074)	68)	(0.0078)	(0.0092)	(0.0085)	(0.0156)	(0.0175)
$X_{6,i,t}$	0.1927***	0.2556***		0.1809**	0.1052	0.1504**		0.1852
	(0.0646)	(0.0641)	n/a[a]	(0.0714)	(0.0722)	(0.0743)	n/a	(0.1602)
λ	0.3248	0.2113	-1.7112**	0.3834	-0.0703	-0.0577	-1.5071*	1.4777*
	(0.3419)	(0.2801)	(0.8671)	(0.4225)	(0.4103)	(0.3360)	(0.7951)	(0.7635)
Adj. R^2	0.2934	0.4081	0.3026	0.4603	0.3599	0.4400	0.3542	0.4877

[a]n/a denotes not applicable.
***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Table 4.8 Results from the Second Stage of Heckman's Two-Step Procedure for Restaurant Firms

	Asset Multiplier				Sales Multiplier			
	$D_{1,i,t}$	$D_{2,i,t}$	$D_{5,i,t}$	$D_{8,i,t}$	$D_{1,i,t}$	$D_{2,i,t}$	$D_{5,i,t}$	$D_{8,i,t}$
Intercept	9.0930***	5.4937***	7.0939***	5.5935***	6.1292***	3.4046**	4.9411***	2.4458*
	(1.4835)	(1.2539)	(1.3443)	(1.2369)	(1.3431)	(1.3479)	(1.2333)	(1.3925)
$D_{i,t}$	2.6197***	-3.6719***	-3.3803***	0.6727*	1.5530**	-3.5381**	-2.4120***	1.1353***
	(0.8964)	(1.4065)	(0.9930)	(0.3557)	(0.7029)	(1.4634)	(0.8359)	(0.3950)
$X_{1,i,t}$	-0.9864***	-0.6018***	-0.7676***	-0.6832***	-0.7853***	-0.4938***	-0.6543***	-0.5116***
	(0.1610)	(0.1358)	(0.1463)	(0.1141)	(0.1455)	(0.1460)	(0.1340)	(0.1291)
$X_{2,i,t}$	2.2580***	2.0341***	2.3518***	2.2444***	1.2770***	1.0556***	1.3409***	1.2453***
	(0.2835)	(0.2488)	(0.2645)	(0.1975)	(0.2557)	(0.2667)	(0.2494)	(0.2242)
$X_{3,i,t}$	1.9994***	1.5910***	1.4622***	1.6400***	3.1646***	2.8474***	2.8067***	2.7795***
	(0.2051)	(0.1770)	(0.1966)	(0.1620)	(0.1862)	(0.1904)	(0.1895)	(0.1828)
$X_{4,i,t}$	0.1287**	0.1639***	0.1144**	0.1576***	0.0862*	0.1101**	0.0732	0.1025**
	(0.0601)	(0.0491)	(0.0541)	(0.0405)	(0.053)	(0.0526)	(0.0516)	(0.0460)
$X_{5,i,t}$	0.0252***	0.0155***	0.0199***	0.0176***	0.0230***	0.0157***	0.0199***	0.0162
	(0.0043)	(0.0036)	(0.0040)	(0.0030)	(0.0039)	(0.0039)	(0.0036)	(0.0034)
$X_{6,i,t}$		0.3021***		0.2395***		0.2414**		0.1429
	n/a[a]	(0.1116)	n/a	(0.0902)	n/a	(0.1178)	n/a	(0.1022)
λ	-1.4548***	1.1799**	1.2510***	-0.0260	-0.9719***	1.1759**	0.8731**	-0.2961
	(0.4016)	(0.5741)	(0.4279)	(0.1817)	(0.3168)	(0.5982)	(0.3623)	(0.2013)
Adj. R^2	0.2007	0.1991	0.1932	0.2278	0.3006	0.2983	0.2927	0.3175

[a]n/a denotes not applicable.
***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Table 4.9 Summary of the Results of the Endogeneity Tests

	Processing		Wholesale		Retail		Restaurant	
	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier
$D_{1,i,t}$	n/a[a]	n/a		+			-	-
$D_{2,i,t}$	+[b]	+[c]	n/a	n/a			+	+
$D_{3,i,t}$	[d]		+		n/a	n/a	n/a	n/a
$D_{4,i,t}$		-[b]	n/a	n/a	n/a	n/a	n/a	n/a
$D_{5,i,t}$	-	-			-	-	+	+
$D_{6,i,t}$			-	-	n/a	n/a	n/a	n/a
$D_{7,i,t}$	-		n/a	n/a	n/a	n/a	n/a	n/a
$D_{8,i,t}$		-		-		+		
$D_{9,i,t}$	-		n/a	n/a	n/a	n/a	n/a	n/a

[a]n/a denotes not applicable.
[b]A positive or negative sign indicates the sign of the coefficient on lambda in the second stage of Heckman's two step procedure.
[c] The darker shaded cells denote the cases in which the signs on lambda using the assets and sales multipliers are the same and the lambdas are both significant.
[d]The lighter shaded cells denote the cases in which the lambdas for both the asset and sales multiplier are insignificant.

CHAPTER 5 - SUMMARY AND CONCLUSIONS

The strategic decision a firm makes in determining where to set its vertical and horizontal boundaries is a widely discussed topic in the literature. While there are many studies that investigate whether there is a premium or a discount that results from diversification, this study contributes several unique ideas to the current literature on this topic. First, the analysis involves a study of one industry, the food economy. Second, it extends the literature by dividing the diversification variable into integration and unrelated diversification.

Vertical and horizontal integration are important topics in the agricultural economics literature but most of the papers are theoretical or current events discussions. There are very few empirical studies examining the impact of vertical and horizontal integration on firm value. The analysis above adds to the literature on this topic with an empirical application.

Because firms diversify and integrate for different reasons, it is not immediately clear how these decisions affect firm value. The objective of this research is to determine whether food economy firms pursuing diversification or integration are valued lower or higher as a whole than the sum of their individual segments would be if they were stand-alone firms. This is commonly referred to as a premium or discount. The hypothesis is that a premium exists for food economy firms that pursue integration activities and a discount exists for food economy firms that pursue diversification activities. Four separate food economy sectors are used in the analysis: food processing, wholesale grocery, retail supermarkets, and restaurants.

To determine whether a premium or discount exists for integration or diversification, an excess value calculation method originally developed by Berger and Ofek (1995) is used which compares the actual value of a firm to the imputed value of all of the segments of a firm. This excess value is then used in an SUR framework to determine how certain firm characteristics influence firm value. But these firm effects may both lead a firm to diversify or integrate and affect firm value. This would incorrectly attribute a discount to the diversification or integration itself and not the underlying firm characteristics that caused the firm to pursue such a strategy. To account for these underlying firm and industry characteristics, Heckman's two-stage procedure is used to control for the self-selection of firms that diversify.

5.1 Conclusions

According to the SUR results, the hypothesis that integration leads to a premium for food economy firms cannot be rejected for the restaurant sector and for the processing sector expect in the case of vertical integration into retail. The hypothesis that integration leads to a premium for food economy firms also cannot be rejected in the wholesale sector for vertical integration into processing ($D_{1,i,t}$) using both multipliers and vertical integration into retail ($D_{3,i,t}$) using the sales multiplier. The hypothesis that integration leads to a premium for food economy firms also cannot be rejected in the retail sector for vertical integration into processing using the asset multiplier ($D_{1,i,t}$), vertical integration into wholesale using the sales multiplier ($D_{2,i,t}$), and horizontal integration using the asset multiplier ($D_{6,i,t}$). The hypothesis that diversification leads to a discount for food economy firms is not rejected for the wholesale sector using the asset multiplier and for the retail sector using the sales multiplier because a discount is found for unrelated diversification ($D_{5,i,t}$) in these cases.

The endogeneity tests indicate that, in most cases, particularly in the processing and restaurant sectors, the diversification or integration decisions are endogenous. In other words, the firm effects that cause firms to diversify or integrate are positively or negatively correlated with firm value. In the cases of vertical integration into wholesale in the processing and restaurant sectors and unrelated diversification in the restaurant sector, including a self selection parameter makes the premiums found using SUR become discounts. Therefore, the hypothesis that there is a premium for integration is rejected in the case of vertical integration into wholesale in the processing and restaurant sectors. The discount found using SUR becomes a premium in the case of vertically integrated wholesale firms. Therefore, the hypothesis that there is a premium for integration cannot be rejected in this case.

The results of this research are important to managers in the food economy who are trying to make strategic decisions regarding diversification and integration. The results can also provide insight to investors who are deciding which companies to invest in and how the integration and diversification decisions of these companies might impact future firm value.

5.2 Limitations and Future Research

One of the limitations of this study is that what is considered unrelated diversification is sometimes not completely unrelated. For example, Anheuser-Busch produces their own cans which is vertical integration but not vertical integration into the food economy, which is what is of interest in this study. Also, Seaboard has a transportation division that could be considered vertical integration but in this research is considered as unrelated diversification. Future research could separate these activities into a category for vertical integration that is outside of the food economy.

Contracting is another form of coordination that is very important in agricultural markets. The Contracting and Organizations Research Institute has collected data on over 65,000 contracts. Combining data used in this study with data regarding contracting and using similar analysis would give interesting insight into how contracting affects firm value.

This research looks at which SIC codes companies report under in a given year but not how these SIC codes are changing across years within firms. There is no distinction made between firms who purchase assets to expand within their current business and firms that purchase other, already established brands or businesses. Investigating these changes over time and how they affect firm value would also be interesting.

This research has found that the decision firms make on where to set horizontal and vertical boundaries is complex for food economy firms. Nonetheless, the research has identified several integration and diversification strategies that have created premiums relative to single segment firms and other strategies which have led to discounts.

References

Abadie, A. and G. Imbens. "Simple and Bias-Corrected Matching Estimators for Average Treatment Effects." University of California, Berkley, working paper. 2002.

Aggarwal, R.K. and A.A. Samwick. "Why Do Managers Diversify Their Firms? Agency Reconsidered." *The Journal of Finance* 58(2003):71-118.

Amihud, Y. and B. Lev. "Risk Reduction as a Managerial Motive for Conglomerate Mergers." *The Bell Journal of Economics* 12(1981):605-617.

Anderson, R.C. and D.M Reeb. "Founding-Family Ownership and Firm Performance: Evidence from the S&P 500." *The Journal of Finance* 58(2003):1301-1328.

Barkema, A., M. Drabenstott, and K. Welch. "The Quiet Revolution in the U.S. Food Market." *Federal Reserve Bank of Kansas City Economic Review*. May/June 1991.

Barry, P.J., S.T. Sonka, and K. Lajili. "Vertical Coordination, Financial Structure, and the Changing Theory of the Firm." *American Journal of Agricultural Economics* 74(1992):1219-1225.

Berger, P.G. and E. Ofek. "Diversification's Effect on Firm Value." *Journal of Financial Economics* 37(1995):39-65.

Bertrand, M. and S. Mullainathan. "Are CEOs Rewarded for Luck? The Ones Without Principals Are." *Quarterly Journal of Economics* 116(2001):901-932.

Besanko, D., D. Dranove, and M. Shanley. *Economics of Strategy*. John Wiley and Sons, New York, NY, 2000.

Bhuyan, S. "Impact of Vertical Mergers on Food Industry Profitability: An Empirical Evaluation." Paper presented at the American Agricultural Economics Association annual meetings, Chicago, IL, August 5-8, 2001.

Boland, M.A., B. Golden, and L. Tsoodle. "Agency Problems in the Food Processing Industry." Unpublished manuscript, Department of Agricultural Economics, Kansas State University, Manhattan, KS, August 2006.

Campa, J.M. and S. Kedia. "Explaining the Diversification Discount." *The Journal of Finance* 57(2002):1731-1762.

Christensen, H.K. and C. A. Montgomery. "Corporate Economic Performance: Diversification Strategy versus Market Structure." *Strategic Management Journal* 2(1981):327-343.

Coase, R.H. "The Nature of the Firm." *Economica* 4(1937):386-405.

Comment, R. and G.A. Jarrell. "Corporate Focus and Stock Returns." *Journal of Financial Economics* 37(1995):67-87.

Cotterill, R.W. "Neoclassical Explanations of Vertical Organization and Performance of Food Industries." *Agribusiness: An International Journal* 17(2001):33-57.

Dehejia, R.H. and S. Wahba. "Causal Effects and Non-Experimental Studies: Re-evaluating the Evaluation of Training Programs." *Journal of the American Statistical Association* 94(1999):1053-1062.

Denis, D.J., D.K. Denis, and K. Yost. "Global Diversification, Industrial Diversification, and Firm Value." *The Journal of Finance* 57(2002):1951-1979.

Ding, J.Y., J.A. Caswell, and F. Zhou. "Relatedness and Performance: A Reexamination of the Diversification-Performance Link." *Journal of Food Distribution Research* 28(1987):66-73.

Frank, S.D. and D.R. Henderson. "Transaction Costs as Determinants of Vertical Coordination in the U.S. Food Industries." *American Journal of Agricultural Economics* 74(1992):941-950.

Freberg, C, M. Boland, and D. Barton. "Profitability and Risk Measures for Investor-Owned Firms." Staff Paper 00-07, Department of Agricultural Economics, Kansas State University, Manhattan, KS, 2000.

Gibbons, R. and K.J. Murphy. "Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence." *Journal of Political Economy* 100(1992):468-505.

Gomes J. and D. Livdan. "Optimal Diversification: Reconciling Theory and Evidence." *The Journal of Finance* 59(2004):507-535.

Graham J.R., M.L. Lemmon, and J.G. Wolf. "Does Corporate Diversification Destroy Value?" *The Journal of Finance* 57(2002):695-720.

Greene, W.H. *Limdep Version 7.0 User's Manual*. Econometric Software, Castle Hill, NSW, Australia, 1998.

Greene, W.H. *Econometric Analysis*. Prentice Hall, Upper Saddle River, NJ, 2003.

Grossman, S.J. and O.D. Hart. "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration." *The Journal of the Political Economy* 94(1986):691-719.

Halvorsen, R. and R. Palmquist. "The Interpretation of Dummy Variables in Semilogarithmic Equations." *The American Economic Review* 70(1980:474-475.

Harris, M., C.H. Kriebel, and A. Raviv. "Asymmetric Information, Incentives and Intrafirm Resource Allocation." *Management Science* 28(1982):604-620.

Harris, J.M., P.R. Kaufman, S.W. Martinez, and C. Price. The U.S. Food Marketing System, 2002: Competition, Coordination, and Technological Innovations Into the 21st Century. Washington DC: U.S. Department of Agriculture, Economic Research Service, AER No. 811, June 2002.

Heckman, J.J. "Sample Selection Bias as a Specification Error." *Econometrica* 47(1979):153-161.

Hennessy, D.A. "Information Asymmetry as a Reason for Food Industry Vertical Integration." *American Journal of Agricultural Economics* 78(1996):1034-1043.

Jensen, M.C. "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers." *The American Economic Review* 76(1986):323-329.

Jensen, M.C. and K.J Murphy. "Performance Pay and Top Management Incentives." *Journal of Political Economy* 98(1990):225-264.

Katchova, A.L. "The Farm Diversification Discount." *American Journal of Agricultural Economics* 87(2005):984-994.

Kennedy, P.E. "Estimation with Correctly Interpreted Dummy Variables in Semilogarithmic Equations." *The American Economic Review* 71(1981):801.

Kinsey, J.D. "The Big Shift From a Food Supply to a Food Demand Chain." *Minnesota Agricultural Economist*, No. 698. University of Minnesota, St. Paul, MN, Fall 1999.

_____. "The New Food Economy: Consumers, Farms, Pharms, and Science." *American Journal of Agricultural Economics* 83(2001): 1113:1130.

Laeven, L. and R. Levine. "Is There a Diversification Discount in Financial Conglomerates?" Forthcoming in the *Journal of Financial Economics*, June 2005.

Lamont O.A. and C. Polk. "The Diversification Discount: Cash Flows versus Returns." *The Journal of Finance* 56(2001):1693-1721.

Lang, L.H.P. and R.M. Stulz. "Tobin's *q*, Corporate Diversification, and Firm Performance." *Journal of Political Economy* 102(1994):1248-1280.

Lewellen, W.G. "A Pure Financial Rationale for the Conglomerate Merger." *The Journal of Finance* 26(1971):521-537.

Lubatkin,M., W.S. Schulze, A. Mainkar, and R.W. Cotterill. "Ecological Investigation of Firm Effects In Horizontal Mergers." Strategic Management Journal 22(2001):335-357.

MacDonald, J., J. Perry, M. Ahearn, D. Banker, W. Chambers, C. Dimitri, N. Key, K. Nelson, L. Southard. Contracts, Markets, and Prices: Organizing the Production and Use of Agricultural Commodities. Washington DC: U.S. Department of Agriculture, Economic Research Service, AER No. 837, November 2004.

Maksimovic, V. and G. Phillips. "Do Conglomerate Firms Allocate Resources Inefficiently Across Industries? Theory and Evidence." *The Journal of Finance* 57(2002):721-767.

Mansi, S.A. and D.M. Reeb. "Corporate Diversification: What Gets Discounted?" *The Journal of Finance* 57(2002):2167-2183.

Martin, J.D. and A. Sayrak. "Corporate Diversification and Shareholder Value: A Survey of Recent Literature." *Journal of Corporate Finance* 9(2003):37-57.

Martinez, S.W. Vertical Coordination in the Pork and Broiler Industries: Implications for Pork and Chicken Products. Washington DC: U.S. Department of Agriculture, Economic Research Service, AER No. 777, April 1999.

Martinez, S.W. Vertical Coordination of Marketing Systems: Lessons From the Poultry, Egg, and Pork Industries. Washington DC: U.S. Department of Agriculture, Economic Research Service, AER No. 807, April 2002.

Meyer, M., P. Milgrom, and J. Roberts. "Organizational Prospects, Influence Costs, and Ownership Changes." *Journal of Economics and Management Strategy* 1(1992):9-35.

Montgomery, C.A. "Corporate Diversification." *Journal of Economic Perspectives* 8(1994):163-178.

Nayyar, P.R. "Stock Market Reactions to Related Diversification Moves by Service Firms Seeking Benefits from Information Asymmetry and Economies of Scope." *Strategic Management Journal* 14(1993):569-591.

Palepu, K. "Diversification Strategy, Profit Performance and the Entropy Measure." *Strategic Management Journal* 6(1985):239-255.

Porter, M.E. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. The Free Press, New York, NY, 1980.

Rajan R., H. Servaes, and L. Zingales. "The Cost of Diversification Discount and Inefficient Investment." *The Journal of Finance* 55(2000):35-80.

Rogers, R.T. "Structural Change in U.S. Food Manufacturing, 1958-1997." *Agribusiness: An International Journal* 17(2001):3-32.

Rumelt, R.P. Strategy, Structure, and Economic Performance, Division of Research, Graduate School of Business Administration, Harvard University, Boston, 1974.

Salter, M.S. and W.A. Weinhold. *Diversification through Acquisition: Strategies for Creating Economic Value*. Collier Macmillan Publishers, London, 1979.

Schoar, A. "Effects of Corporate Diversification on Productivity." *The Journal of Finance* 57(2002):2379-2403.

Schumacher, S.K. and M.A. Boland. "Persistence of Profitability among Firms in the Food Economy." *American Journal of Agricultural Economics* 87(2005):103-115.

Servaes, H. "The Value of Diversification During the Conglomerate Merger Wave." *The Journal of Finance* 51(1996):1201-1225.

Sexton, R.J. "Industrialization and Consolidation in the U.S. Food Sector: Implications for Competition and Welfare." *American Journal of Agricultural Economics* 82(2000):1087-1104.

Sonka, S.T. and M.A. Hudson. "Why Agribusiness Anyway?" *Agribusiness: An International Journal* 5(1989):305-314.

Stein, J.C. "Internal Capital Markets and the Competition for Corporate Resources." *The Journal of Finance* 52(1997):111-133.

Stigler, G.J. "The Division of Labor is Limited by the Extent of the Market." *Journal of Political Economy* 59(1951):185-193.

Stulz, R.M. "Managerial Discretion and Optimal Financing Policies." *Journal of Financial Economics* 26(1990):3-27.

Tobin, J. "A General Equilibrium Approach to Monetary Theory." *Journal of Money, Credit, and Banking* 1(1969):15-29.

U.S. Department of Commerce, *U.S. Industry and Trade Outlook 2000*, McGraw-Hill, NY, 2000.

U.S. Department of Labor. 2006. SIC Division Structure. http://www.osha.gov/pls/imis/sic_manual.html.

Villalonga, B. "Diversification Discount or Premium? New Evidence from the Business Information Tracking Series." *The Journal of Finance* 59(2004a):479-506.

___ "Does Diversification Cause the "Diversification Discount"?" *Financial Management* 33(2004b):5-27.

Villalonga, B. and R. Amit. "How do Family Ownership, Control, and Management Affect Firm Value?" *Journal of Financial Economics* 80(2006):385-417.

Williamson, O.E. "Comparative Economic Organization: The Analysis or Discrete Structural Alternatives." *Administrative Science Quarterly* 36(1991):269-296.

Wernerfelt, B. and C.A. Montgomery. "Tobin's *q* and the Importance of Focus in Firm Performance." *The American Economic Review* 78(1988):246-250.

Young, L.M. and J.E. Hobbs. "Vertical Linkages in Agri-Food Supply Chains: Changing Roles for Producers, Commodity Groups, and Government Policy." *Review of Agricultural Economics* 24(2002):428-441.

Appendix A - Relevant U.S. Department of Commerce SIC Code Classifications

Below are the SIC classifications and codes used in this study as given by the US Department of Labor's Occupational Safety and Health Administration at http://www.osha.gov/pls/imis/sic_manual.html.

Division D: Manufacturing

- Major Group 20: Food and Kindred Products
  - Industry Group 201: Meat Products
    - 2011 Meat Packing Plants
    - 2013 Sausages and Other Prepared Meat Products
    - 2015 Poultry Slaughtering and Processing
  - Industry Group 202: Dairy Products
    - 2021 Creamery Butter
    - 2022 Natural, Processed, and Imitation Cheese
    - 2023 Dry, Condensed, and Evaporated Dairy Products
    - 2024 Ice Cream and Frozen Desserts
    - 2026 Fluid Milk
  - Industry Group 203: Canned, Frozen, and Preserved Fruits and Vegetables
    - 2032 Canned Specialties
    - 2033 Canned Fruits, Vegetables, Preserves, Jams, and Jellies
    - 2034 Dried and Dehydrated Fruits, Vegetables, and Soup Mixes

2035 Pickled Fruits and Vegetables, Vegetable Sauces and Seasonings, and Salad Dressings

2037 Frozen Fruits, Fruit Juices, and Vegetables

2038 Frozen Specialties, Not Elsewhere Classified

Industry Group 204: Grain Mill Products

2041 Flour and Other Grain Mill Products

2043 Cereal Breakfast Foods

2044 Rice Milling

2045 Prepared Flour Mixes and Doughs

2046 Wet Corn Milling

2047 Dog and Cat Food

2048 Prepared Feed and Feed Ingredients for Animals and Fowls, Except Dogs and Cats

Industry Group 205: Bakery Products

2051 Bread and Other Bakery Products, Except Cookies and Crackers

2052 Cookies and Crackers

2053 Frozen Bakery Products, Except Bread

Industry Group 206: Sugar and Confectionary Products

2061 Cane Sugar, Except Refining

2062 Cane Sugar Refining

2063 Beet Sugar

2064 Candy and Other Confectionary Products

2066 Chocolate and Cocoa Products

2067 Chewing Gum

2068 Salted and Roasted Nuts and Seeds

Industry Group 207: Fats and Oils

2074 Cottonseed Oil Mills

2075 Soybean Oil Mills

2076 Vegetable Oil Mills, Except Corn, Cottonseed, and Soybean

2077 Animal and Marine Fats and Oils

2079 Shortening, Table Oils, Margarine, and Other Edible Fats and Oils, Not Elsewhere Classified

Industry Group 208: Beverages

2082 Malt Beverages

2083 Malt

2084 Wines, Brandy, and Brandy Spirits

2085 Distilled and Blended Liquors

2086 Bottled and Canned Soft Drinks and Carbonated Waters

2087 Flavoring Extracts and Flavoring Syrups, Not Elsewhere Classified

Industry Group 209: Miscellaneous Food Preparations and Kindred

2091 Canned and Cured Fish and Seafood

2092 Prepared Fresh and Frozen Fish and Seafoods

2095 Roasted Coffee

2096 Potato Chips, Corn Chips, and Similar Snacks

2097 Manufactured Ice

2098 Macaroni, Spaghetti, Vermicelli, and Noodles

2099 Food Preparations, Not Elsewhere Classified

Division F: Wholesale Trade

Major Group 51: Wholesale Trade Non-durable Goods

Industry Group 514: Groceries and Related Products

5141 Groceries General Line

Division G: Retail Trade

Major Group 54: Food Stores

5411 Grocery Stores

Major Group 58: Eating and Drinking Places

5812 Eating Places

Appendix B - Numerical Example of Excess Value Calculations

Suppose firm *i* operates in a food economy where there are five firms and all five firms operate in the same segment, segment 1, meaning the firms are not diversified. We will call segment 1 cookies and crackers manufacturing in this example. For firms in this segment, total capital, V_{i1} = [0.9, 1, 1.1, 1.2, 1.3] and, the value of assets, a_{i1} = [1, 1.1, 1.15, 1.25, 1.35]. Therefore, the median ratio for segment 1, using equation (1), is

(22) $$\frac{V_{m1}}{a_{m1}} = \frac{1.1}{1.15} = 0.9565$$

Now suppose there is one more firm, firm 6, that is diversified. This firm is diversified into two segments, segment 1 (cookies and crackers manufacturing) and segment 2 (meat packing). Assume the median ratio was calculated for segment 2, just as it was for segment 1 in (22) above and we found that $V_{m2} / a_{m2} = 1.17$. Also, assume that a_{6j} = [3.2, 3.4].

So, using equation (2),

(23) $$IV_{61} = 3.2 \text{ x } 0.9565 = 3.0608$$

and

(24) $$IV_{62} = 3.4 \text{ x } 1.17 = 3.978$$

So, inserting (23) and (24) into (3) yields,

(25) $$IV_{6} = 3.0608 + 3.978 = 7.0388$$

Now assume that total capital for firm 6 is 6.4 so V6 = 6.4. Using equation (4) we find

(26) $$EV_{6} = \ln (6.4 / 7.0388) = \ln(0.9092) = -0.0951.$$

Thus, $V_6 < IV_6$ or $6.4 < 7.0388$. This suggests that, for the diversified firm in this example, excess value is negative and the value of the firm is less than the sum of the imputed values of its segments.

Appendix C - Binary Variable Aggregation Details

Table C.1 Integration and Diversification Categories

Variable Name	Variable Definition	Number of Firms
D_1	vertical integration - processing	69
D_2	vertical integration - wholesale	48
D_3	vertical integration - retail	46
D_4	vertical integration - restaurants	27
D_5	vertical integration - production	9
D_6	horizontal integration	232
D_7	unrelated diversification	171
D_8	vertical integration - processing and horizontal integration	2
D_9	vertical integration - wholesale and horizontal integration	17
D_{10}	vertical integration - retail and horizontal integration	17
D_{11}	vertical integration - restaurants and horizontal integration	30
D_{12}	vertical integration - production and horizontal integration	4
D_{13}	vertical integration - processing and unrelated diversification	8
D_{14}	vertical integration - wholesale and unrelated diversification	6
D_{15}	vertical integration - retail and unrelated diversification	0
D_{16}	vertical integration - restaurants and unrelated diversification	0
D_{17}	vertical integration - production and unrelated diversification	8
D_{18}	horizontal integration and unrelated diversification	50
D_{19}	vertical integration - processing and horizontal integration and unrelated diversification	0
D_{20}	vertical integration - wholesale and horizontal integration and unrelated diversification	0
D_{21}	vertical integration - retail and horizontal integration and unrelated diversification	3
D_{22}	vertical integration - restaurants and horizontal integration and unrelated diversification	0
D_{23}	vertical integration - production and horizontal integration and unrelated diversification	4

Table C.2 Binary Variable Specification

Variable Name	Variable Definition	Number of Firms: Processing	Wholesale	Retail	Restaurant	Total
$D_{1,i,t}$	$D_1+D_8+D_{13}+D_{19}$	0	25	14	40	79
$D_{2,i,t}$	$D_2+D_9+D_{14}+D_{20}$	27	0	25	19	71
$D_{3,i,t}$	$D_3+D_{10}+D_{15}+D_{21}$	5	61	0	0	66
$D_{4,i,t}$	$D_4+D_{11}+D_{16}+D_{22}$	57	0	0	0	57
$D_{5,i,t}$	D_7	91	16	31	34	172
$D_{6,i,t}$	D_6	220	11	0	0	231
$D_{7,i,t}$	D_{18}	50	0	0	0	50
$D_{8,i,t}$	Single segment firms	1481	134	400	1313	3328
$D_{9,i,t}$	$D_5+D_{12}+D_{17}+D_{23}$	24	0	0	0	24

Appendix D - SUR Results with Time Trend

Table D.1 Seemingly Unrelated Regression Results for Food Economy Firms by Sector with Each Multiplier as Dependent Variable with Time Trend

	Processing		Wholesale		Retail		Restaurants	
	Asset Multiplier	**Sales Multiplier**	**Asset Multiplier**	**Sales Multiplier**	**Asset Multiplier**	**Sales Multiplier**	**Asset Multiplier**	**Sales Multiplier**
Intercept	0.0022	0.0017	0.0002	0.0001	0.0000	0.0000	0.0008	0.0005
	(0.0086)	(0.0095)	(0.0028)	(0.0036)	(0.0025)	(0.0029)	(0.0067)	(0.0074)
$X_{1,i,t}$	-0.0259***	-0.0541***	0.0784***	0.0762***	-0.0706***	-0.0848***	-0.0071	-0.1333***
	(0.0058)	(0.0064)	(0.0084)	(0.0107)	(0.0052)	(0.0060)	(0.0072)	(0.0079)
$X_{2,i,t}$	1.4943***	1.6140***	-1.4281***	-0.8691***	11.8213***	14.8652***	1.9630***	1.0709***
	(0.1041)	(0.1152)	(0.1212)	(0.1556)	(0.3372)	(0.3916)	(0.1165)	(0.1281)
$X_{3,i,t}$	0.2632**	2.0070***	-0.0844	2.8876***	-0.1652	4.8593***	1.5665***	2.8373***
	(0.1243)	(0.1376)	(0.1281)	(0.1644)	(0.2222)	(0.2580)	(0.0836)	(0.0920)
$X_{4,i,t}$	-0.0269	0.0116	0.5657***	0.0830	-0.1511***	-0.1513***	0.2003***	0.1345***
	(0.0452)	(0.0500)	(0.0555)	(0.0713)	(0.0346)	(0.0402)	(0.0239)	(0.0262)
$X_{5,i,t}$	0.0008***	0.0021***	-0.0031***	-0.0037***	0.0031***	0.0035***	-0.0004	0.0060***
	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0002)	(0.0003)	(0.0003)	(0.0004)
$X_{6,i,t}$	0.2208***	0.1340***	-0.0928	-0.1149	0.1893***	0.1049***	0.2597***	0.2008***
	(0.0218)	(0.0242)	(0.0772)	(0.0991)	(0.0181)	(0.0210)	(0.0515)	(0.0566)
Year	0.0154**	0.0054	-0.0779***	-0.0348***	-0.0008	-0.0350***	0.0029	0.0167**
	(0.0066)	(0.0073)	(0.0082)	(0.0106)	(0.0051)	(0.0060)	(0.0074)	(0.0081)
Year^2	-0.0007***	-0.0003	0.0023***	-0.0001	-0.0004**	0.0005**	-0.0001	-0.0007**
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0002)	(0.0002)	(0.0003)	(0.0003)
$D_{1,i,t}$			-1.0846***	-1.4056***	-0.6959***	-0.8606***	-0.5815***	-0.5850***
	n/a[a]	n/a	(0.0393)	(0.0505)	(0.0418)	(0.0485)	(0.0559)	(0.0615)
$D_{2,i,t}$	-0.8304***	-0.9721***			-1.1499***	-1.2006***	-0.9332***	-0.7792***
	(0.0772)	(0.0855)	n/a	n/a	(0.0321)	(0.0372)	(0.0803)	(0.0883)

$D_{3,i,t}$	-0.2165	-0.0849	-0.9079***	-1.0836***				
	(0.1769)	(0.1958)	(0.0312)	(0.0400)	n/a	n/a	n/a	n/a
$D_{4,i,t}$	-0.7568***	-0.7300***						
	(0.0542)	(0.0600)	n/a	n/a	n/a	n/a	n/a	n/a
$D_{5,i,t}$	-0.0618	-0.0588	-0.2633***	0.1568**	-0.4930***	-0.4345***	-0.5781***	-0.4546***
	(0.0430)	(0.0476)	(0.0524)	(0.0673)	(0.0289)	(0.0335)	(0.0606)	(0.0667)
$D_{6,i,t}$	-0.8003***	-0.7443***	-0.2584***	-0.5053***	-0.5310***	-0.3821**		
	(0.0300)	(0.0332)	(0.0592)	(0.0760)	(0.1511)	(0.1754)	n/a	n/a
$D_{7,i,t}$	-0.9922***	-0.9426***						
	(0.0574)	(0.0635)	n/a	n/a	n/a	n/a	n/a	n/a
$D_{9,i,t}$	-0.4570***	-0.7549***						
	(0.0819)	(0.0907)	n/a	n/a	n/a	n/a	n/a	n/a
System Weighted R^2	0.3998	0.4651						

[a]n/a denotes not applicable.
***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Appendix E - Probit Results

Table E.1 Probit Results from the First Stage of Heckman's Two-Step Procedure for Processing Firms

	$D_{2,i,t}$	ME	$D_{3,i,t}$	ME	$D_{4,i,t}$	ME	$D_{5,i,t}$	ME
Intercept	-5.2558	-0.1532	-40.8269	-0.0476	3.1962	0.1844	-9.7269***	-1.0005
	(4.9414)		(30.8809)		(3.1397)		(3.5340)	
$X_{1,i,t}$	0.2638	0.0077	3.5300	0.0041	-0.5794*	-0.0334	0.7303**	0.0751
	(0.5022)		(2.9207)		(0.3215)		(0.3535)	
$X_{2,i,t}$	-1.6547*	-0.0482	2.0212	0.0024	-1.0307	-0.0595	0.3623	0.0373
	(0.9402)		(2.6018)		(0.6275)		(0.6715)	
$X_{3,i,t}$	-3.6952*	-0.1077	-1.4363	-0.0017	0.7404	0.0427	-1.7294	-0.1779
	(2.2364)		(4.0913)		(0.6720)		(1.0901)	
$X_{4,i,t}$	-0.0945	-0.0028	0.3106	0.0004	-0.5068	-0.0292	-0.0028	-0.0003
	(0.3877)		(0.9459)		(0.3317)		(0.2591)	
$X_{5,i,t}$	-0.0048	-0.0001	-0.0815	-0.0001	0.0166**	0.0010	-0.0158***	-0.0016
	(0.0126)		(0.0688)		(0.0081)		(0.0087)	
$X_{6,i,t}$	0.1217	0.0038	-0.3030	-0.0003	-0.4536***	-0.0215	0.0347	0.0036
	(0.1708)		(0.3631)		(0.1754)		(0.1058)	
	$D_{6,i,t}$	ME	$D_{7,i,t}$	ME	$D_{8,i,t}$	ME	$D_{9,i,t}$	ME
Intercept	-0.3138	-0.0512	-7.4810	-0.3496	0.1491	0.0442	-3.3855	-0.0461
	(2.5620)		(4.7133)		(2.0500)		(5.6357)	
$X_{1,i,t}$	-0.2685	-0.0438	0.4376	0.0205	0.2464	0.0731	-0.0612	-0.0008
	(0.2580)		(0.4699)		(0.2084)		(0.5565)	
$X_{2,i,t}$	-0.4897	-0.0798	-1.1919	-0.0557	0.8903**	0.2640	-2.5341**	-0.0345
	(0.5391)		(0.7970)		(0.4104)		(1.0867)	
$X_{3,i,t}$	-1.8736**	-0.3055	0.4624	0.0216	1.2130**	0.3596	-7.4207*	-0.1011
	(0.8583)		(0.8692)		(0.5950)		(3.8242)	
$X_{4,i,t}$	-0.0513	-0.0084	-0.9705**	-0.0454	0.3024*	0.0897	0.4307	0.0059
	(0.2162)		(0.4151)		(0.1767)		(0.4073)	
$X_{5,i,t}$	0.0116*	0.0019	-0.0071	-0.0003	-0.0116**	-0.0034	0.0063	0.0001

	(0.0064)		(0.0115)		(0.0052)		(0.0135)	
$X_{6,i,t}$	-0.3734***	-0.0540	-0.2641*	-0.0109	0.3285***	0.0912	0.2290	0.0036
	(0.0977)		(0.1545)		(0.0786)		(0.1859)	

***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Table E.2 Probit Results from the First Stage of Heckman's Two-Step Procedure for Wholesale Firms

	$D_{1,i,t}$	ME	$D_{3,i,t}$	ME	$D_{5,i,t}$	ME	$D_{6,i,t}$	ME	$D_{8,i,t}$	ME
Intercept	-73.103***	-2.3591	-56.653***	-7.3302	-90.047***	-0.0357	-75.581	-0.0153	30.393***	11.7974
	(24.0817)		(19.6072)		(32.0895)		(57.0422)		(8.0493)	
$X_{1,i,t}$	7.4125***	0.2392	5.2589***	0.6804	10.497***	0.0042	6.9619	0.0014	-2.8984***	-1.1251
	(2.4806)		(1.9409)		(3.7840)		(5.5247)		(0.8436)	
$X_{2,i,t}$	6.9421	0.2240	-4.7331	-0.6124	-3.7180***	-0.0015	4.9241	0.0010	3.6572***	1.4196
	(6.2007)		(3.1916)		(1.4468)		(23.0844)		(1.2420)	
$X_{3,i,t}$	-8.2540	-0.2664	-3.3470	-0.4331	1.2895	0.0005	-3.6440	-0.0007	-0.8986	-0.3488
	(10.3016)		(6.5194)		(1.8501)		(33.8364)		(1.5548)	
$X_{4,i,t}$	1.0437	0.0337	1.1203*	0.1450	0.0440	0.0000	-6.2124**	-0.0013	-0.6096	-0.2366
	(0.6749)		(0.6322)		(0.6349)		(2.6025)		(0.4479)	
$X_{5,i,t}$	-0.1908***	-0.0062	-0.1225**	-0.0158	-0.3089***	-0.0001	-0.1593	0.0000	0.0684***	0.0265
	(0.0638)		(0.0479)		(0.1113)		(0.1339)		(0.0219)	
$X_{6,i,t}$	0.6585	0.0428	n/a[a]	n/a	n/a	n/a	n/a	n/a	0.2872	0.1067
	(0.5475)								(0.5326)	

[a]n/a denotes not applicable.

***Significant at the 1% level.

**Significant at the 5% level.

*Significant at the 10% level.

Table E.3 Probit Results from the First Stage of Heckman's Two-Step Procedure for Retail Firms

	$D_{1,i,t}$	ME	$D_{2,i,t}$	ME	$D_{5,i,t}$	ME	$D_{8,i,t}$	ME
Intercept	-48.5889*	-1.8369	-10.6436	-0.6542	-13.6697	-1.5371	18.7905*	4.1703
	(29.2858)		(19.4830)		(13.5006)		(11.0463)	
$X_{1,i,t}$	4.6696	0.1765	0.4931	0.0303	1.1124	0.1251	-1.5666	-0.3477
	(2.8852)		(1.8366)		(1.3167)		(1.0675)	
$X_{2,i,t}$	17.4383**	0.6593	-11.6801**	-0.7179	-5.7616	-0.6479	3.2129	0.7131
	(7.5061)		(5.6555)		(4.3393)		(3.6119)	
$X_{3,i,t}$	-1.8645	-0.0705	-0.3709	-0.0228	1.3982	0.1572	0.6817	0.1513
	(5.2197)		(4.5439)		(2.8100)		(2.6259)	
$X_{4,i,t}$	1.5442***	0.0584	0.8675*	0.0533	-1.5086***	-0.1696	-0.1612	-0.0358
	(0.5106)		(0.4484)		(0.5758)		(0.3323)	
$X_{5,i,t}$	-0.1187*	-0.0045	-0.0033	-0.0002	-0.0240	-0.0027	0.0338	0.0075
	(0.0707)		(0.0432)		(0.0320)		(0.0256)	
$X_{6,i,t}$	0.0970	0.0039	0.4558*	0.0372	n/a[a]	n/a	0.2057	0.0425
	(0.3260)		(0.2452)				(0.1929)	

[a]n/a denotes not applicable.
***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.

Table E.4 Probit Results from the First Stage of Heckman's Two-Step Procedure for Restaurant Firms

	$D_{1,i,t}$	ME	$D_{2,i,t}$	ME	$D_{5,i,t}$	ME	$D_{8,i,t}$	ME
Intercept	-43.2098***	-0.9775	-37.5193***	-0.4786	-7.3332	-0.2078	24.3928***	1.7324
	(11.7885)		(14.0285)		(5.3456)		(5.6439)	
$X_{1,i,t}$	4.3032***	0.0973	3.7001**	0.0472	0.6132	0.0174	-2.4064***	-0.1709
	(1.2447)		(1.4874)		(0.5770)		(0.6010)	
$X_{2,i,t}$	3.0390*	0.0687	-1.6667	-0.0213	2.7737*	0.0786	-2.0536*	-0.1459
	(1.7475)		(1.5052)		(1.5980)		(1.1324)	
$X_{3,i,t}$	-5.7555***	-0.1302	-6.2129**	-0.0793	-8.0562***	-0.2283	7.7233***	0.5485
	(1.8089)		(2.4890)		(2.0657)		(1.3866)	
$X_{4,i,t}$	-0.0342	-0.0008	-0.2649	-0.0034	-0.7196**	-0.0204	0.4129*	0.0293
	(0.2609)		(0.3648)		(0.3549)		(0.2157)	
$X_{5,i,t}$	-0.1104***	-0.0025	-0.0944**	-0.0012	-0.0154	-0.0004	0.0608***	0.0043
	(0.0327)		(0.0392)		(0.0154)		(0.0158)	
$X_{6,i,t}$	n/a[a]		0.1114	0.0016	n/a	n/a	0.8384**	0.0299
		n/a	(0.4353)				(0.4115)	

[a]n/a denotes not applicable.
***Significant at the 1% level.
**Significant at the 5% level.
*Significant at the 10% level.