Journal of Agricultural and Applied Economics, 41,3(December 2009):585–598

The Impact of Integration Strategies on Food Business Firm Value

Sarah Dorsey and Michael Boland

The objective of this study is to analyze whether a discount or premium exists for coordination strategies in food processing, wholesale grocery, retail supermarkets, and restaurants. Significant premiums are found for food processor and restaurant vertical integration or diversification strategies. Significant discounts are found for food wholesaler and retail supermarket integration or diversification strategies. Food processors are found to be integrating toward retail supermarkets during this time period.

Key Words: agribusiness, food, institutional economics, integration

JEL Classifications: Q13, L66, L14

Analyzing integration strategies in the food economy is an important research topic in the field of industrial organization in agricultural economics (Sexton, 2000). However, there has been no research that has measured the impact of these strategies on firm value. This study is the first to measure the impact of these strategies on firm value. The objective of this study is to analyze whether a discount or premium exists for integration or diversification in food processing, wholesale grocery, retail supermarkets, and restaurants. Individual corporate segment data are used in this study. If the sum of the imputed values of the individual segments of the firm is greater (less) than the actual value of the firm, additional (lacking) value exists that may be attributable to an integration or diversification premium (discount).

Literature Review

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 that it refers to firms pursuing activities that are in the same stage in the marketing system. A related term is diversification meaning that firms can pursue activities outside of their core businesses. For the purposes of this article, diversification refers to activities outside of the food economy. This is done to distinguish diversification from vertical or horizontal integration in the food economy.

For example, the beverage company, Pepsico, acquired a group of restaurant chains including Pizza Hut and Taco Bell in the 1980s. This was considered horizontal integration because Pepsico sought to extend its managerial economies of scope across its distribution system. They later divested these assets in the mid1990s. Sara Lee,

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Journal manuscript number 09-315-j of the Kansas Agricultural Experiment Station. Funding for this research was provided, in part, by the Agricultural Marketing Resource Center. The authors would like to thank John Crespi for helpful comments and suggestions.

a meat processor and baked goods company, owns the Hanes clothing line, which is considered diversification because it is a business not related to its core food businesses. Each firm in the data was carefully analyzed using its annual 10-K report to determine whether it was an integration strategy (Pepsico) or a diversification strategy (Sara Lee).

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 cited for integration in the food economy. A firm using horizontal integration as a business strategy may achieve economies of improved processing technologies and marketing techniques. Barkema, Drabenstott, and Welch (1991) and Young and Hobbs (2002) suggest a premium for being vertically aligned.

The literature has generally found a discount from diversification for firms in the U.S. economy (Berger and Ofek, 1995; Laeven and Levine, 2005; Lang and Stulz, 1994; Servaes, 1996). Katchova (2005) found a discount from diversification in farming operations but this issue has not been tested for food firms beyond the farm gate. One exception is Frank and Henderson (1992) whose Table 1 shows the extent of vertical integration in the food processing sector in 1982. Furthermore, none of these previous studies have analyzed the integration premium or discount.

Reasons Why Firms Integrate

The literature has identified three broad theories on why firms integrate. These are transactions costs theory, agency theory, and contractual incompleteness theory. A brief overview of each theory is presented below. Boland, Golden, and Tsoodle (2008) describe various applications of each theory in the management and agricultural economics literature.

Transactions costs was first articulated by Coase (1937) who discussed 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 (e.g., integrating) other firms that already produce the inputs needed instead of contracting with them.

Agency theory explains why one party (the principal) determines the work for which another party (the agent) undertakes (Jensen and Meckling, 1976). An agent has an incentive to shirk and the principal must structure the transaction such that the agent does not shirk. While this theory has been used to explain contractual arrangements, in circumstances where a principal cannot structure such a contract, actual integration will occur.

Grossman and Hart (1986) discuss the contractual incompleteness issue and how it is applied to property rights, in particular. They conclude 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. 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)

Reasons Why Firms Diversify

Diversification is different from integration in the sense that a firm integrates backward or forward in the marketing channel in related businesses to achieve lower costs or control over the quality of an input whereas diversification is a portfolio strategy that occurs outside of the marketing channel. A detailed review of over 20 articles is presented in Dorsey (2006). With regard to the agribusiness literature, Ding, Caswell, and Zhou (1987) found a lack of positive correlation between performance as measured by stock price and diversification. Diversification reached its heyday in the 1960s and 1970s when firms (e.g., conglomerates) diversified as a means of developing a portfolio of businesses that were not related with each other.

Among agribusinesses, General Mills was probably the most well known conglomerate and in 1975, General Mills had diversified into 13 different divisions including Restaurants, Toys, Packaged Foods, Chemicals, Snack Foods, Travel Agency, Furniture, Fashion, Collectibles, Direct Marketing, Cereals, and Mixes and Flours (Taylor, Brester, and Boland, 2005). Snack Foods, Cereals, and Mixes and Flours would be considered horizontal integration. Restaurants and these three divisions would be considered vertical integration. Combinations of the other businesses would be considered diversification.

Measuring the Integration Discount or Premium

Berger and Ofek's (1995) model for measuring the impact of diversification is modified to measure the vertical or horizontal integration or diversification discount or premium. The conceptual model is the following:

Excess Value = f(firm effects, binary variables to measure integration or diversification)

Estimation of this model results in an estimated Excess Value (EV) that is used to calculate a discount or premium from integration or diversification. 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 business segments. Imputed firm value can be calculated by computing values for each individual business segment as reported by the firm to the U.S. Securities and Exchange Commission (SEC) and comparing the sum of these values to the actual value of the firm as a whole. If the sum of the imputed values of the individual segments is greater (less) than the actual value of the firm, additional (lacking) value exists that may be attributable to an integration or diversification premium (discount). The 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. The following paragraphs explain, in detail, how EV is calculated.

In each industry, there are firms who operate in only one segment. 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 from other parts of the firm. A firm reports its financial data to the SEC under a specific SIC code if its sales, assets, or earnings before interest and taxes (EBIT) are at least 10% of the firm total. Therefore, if a firm operates in only one segment, it reports under only one four-digit SIC code. The median ratio of total capital (market value of common equity plus book value of debt) to assets is calculated as

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

where V_{ij} is total capital for firm i in segment j, a_{ij} is total assets for firm i in segment j, n is the number of firms in segment j, and m is the firm with the median ratio.[1] An imputed value for each segment of each firm can then be defined, using the ratio in Equation (1), as:

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

where IV_{ij} is the imputed value for segment j of firm i and a_{ij} is assets for firm i in segment j.

[1] As in Berger and Ofek (1995) and other studies using this value calculation method, the median ratio is used instead of the mean ratio to account for skewness in the data distributions. 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 wholesale firms, 42% of the median calculations use four digit SIC codes and 52% use three digit SIC codes. 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. For retail and restaurant firms, 99% of the median calculations use four digit SIC codes and 1% use three digit SIC codes.

The imputed value for the entire firm including all J of its segments is then:

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

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

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

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

Unallocated assets may be a problem when making the value calculations described above. Therefore, consistent with Berger and Ofek (1995), 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 value is adjusted up or down by the percentage difference between the sum of the segment assets and the total firm assets. The sales multiplier is adjusted in a similar manner. After all firm calculations are complete, outliers are removed for each of the two value measures. Outliers are defined as those values that are three standard deviations above or below the mean for each of the multipliers. Six percent of the observations were deleted as outliers.

Description of the Exogenous Model for Explaining Integration or Diversification

The value measure shown in Equation (4) is used in the following model to further analyze the effect of integration or diversification on firm value, where these are exogenously determined. This means that the model shows how certain firm effects influence value, but not how these characteristics influence the integration or diversification decision. Schumacher and Boland (2005) show how the food economy can be characterized into food processing, wholesale grocery, retail supermarkets, and restaurants. The mathematical representation of the conceptual model is estimated for these four sectors separately and is defined as:

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

where $EV_{i,t}$ is the 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 according to the definitions given in Table 1 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 1. The parameters to be estimated are α, β, and γ and ε is the error term.

Description of the Independent Variables

The ratio of capital expenditures to sales, net margin, and assets has been widely used in previous literature as firm effect variables for explaining the value of a firm. These are the only firm effects' variables available for segment level data. The ratio of capital expenditures to sales is an indication of firm growth because it shows the change in capital spending as sales increase. Net margin is the ratio of 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 value of a firm. A quadratic size term is also added because the effect of size on value may be nonlinear due to decreasing marginal returns.

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 excessive leverage is generally thought to have a negative effect on

Table 1. Variable Definitions

Symbol	Variable	Definition
$EV_{i,t}$	Value	Value of the firm
$X_{1,i,t}$	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
$D_{1,i,t}$	VI-Processing	Binary variable that equals one if firm *i* is Vertically Integrated into processing in year *t* and 0 otherwise
$D_{2,i,t}$	VI-Wholesale	Binary variable that equals one if firm *i* is Vertically Integrated into wholesale in year *t* and 0 otherwise
$D_{3,i,t}$	VI-Retail	Binary variable that equals one if firm *i* is Vertically Integrated into retail in year *t* and 0 otherwise restaurants
$D_{4,i,t}$	VI-Restaurant	Binary variable that equals one if firm *i* is Vertically Integrated into in year *t* and 0 otherwise
$D_{5,i,t}$	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
$D_{7,i,t}$	Diversification-HI	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
$D_{9,i,t}$	VI-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.

firm value. However, there are sound tax reasons why some leverage is desirable. The finance literature has consistently found a negative effect for leverage. Boyd et al. (2007) provide a literature review of management as a firm effect variable in explaining profitability and found that, due to data limitations, it was not possible to use such a variable when employing firm-level data as opposed to farm-level data. A variable for management is not included but is considered part of any unexplained variation in the model.

The variable to indicate control is included due to the finding by Anderson and Reeb (2003) that family-controlled firms are more profitable than nonfamily controlled firms. The variable for control is binary and equals one if the founding family is the largest equity holder and 0 otherwise. Family control is a firm effect variable. Family firms were identified using corporate histories from Hoovers, The Corporate Library, individual company records including SEC documents, and data from Anderson and Reeb.

The binary variables ($D_{i,t}$) defined in Table 1 and used in Equation (5) were initially assigned into 23 different, nonoverlapping categories based on the diversification and/or integration strategy the firms were pursuing in a particular year. Annual 10-K reports for food economy firms obtained from the SEC and compiled by Standard and Poor's *Compustat* were used to determine whether an individual firm was diversified or integrated within its segments in each year. Then, a determination was made as to whether the strategy being pursued by each firm was integration or diversification. Due to a small number of firms in some of the categories, the variables were aggregated into the nine binary variables shown in Table 1. 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.

The model was estimated in the following form for each of the four food economy sectors using seemingly unrelated regression (SUR):

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

where α, β, and γ are parameters to be estimated and ε is the error term. $D_{8,i,t}$ 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.

Description of the Endogenous Model for Explaining Integration or Diversification

As discussed by Campa and Kedia (2002) and Laeven and Levine (2007), certain firm and industry effects may 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. Heckman's (1979) two-stage procedure is used to control for the self-selection of firms that diversify.

Both the first and second stages of Heckman's (1979) two step procedure are estimated using each binary variable for each food economy sector separately. For example, in one case, the binary variable that indicates vertical integration into processing ($D_{1,i,t}$) for restaurant firms is used as the dependent variable in the first stage probit model and the lambdas calculated from these results in the second stage.

Firm effects can be thought of as measuring the effect of implementation or execution. For example, a well executed strategy leads to increased margins, which results in a firm being profitable and able to retain earnings for growth and the purchase of new assets or replacement of existing assets with more productive assets. Similarly, a capital structure with greater equity leads to an improved leverage ratio. The correlation of firm effects with the decision to diversify or integrate is analogous to a firm's ability to have better management talent to implement the diversification or integration plan. All of these would lead to a premium for integration or diversification.

Description of the Data

The data used in this study are taken from Standard and Poor's Compustat database and include data from 416 food business firms totaling 4,079 observations for 1983–2005. To be used in the study, a firm had to report under SIC codes for one or more of the following sectors: food processing, food wholesale, food retail, or restaurants. The 416 firms have one to four segments of data and the combinations of each by year sum to 4,079 observations. The data are unique in that they include financial information for the individual business segments as well as the firm as a whole. Table 2 provides means, medians, and standard deviations for the independent variables in Equation (5) as well as the number of segments. Table 3 shows the median and mean values broken out by multiplier, sector of the food economy, and diversification status as well as the number of observations in each subset.

The single segment median values for processing firms is zero as is expected because it is the log of a value that should be equal to one for single segment firms. The median value for multisegment processing firms is -0.7076 using the asset multiplier and -0.6675 using the sales multiplier. The mean values for processing firms are -0.5864 using the asset multiplier and

Table 2. 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
Multisegment 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
Multisegment 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
Multisegment 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
Multisegment 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
Multisegment 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.

Table 3. Mean and Median 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
Multisegment firms	−0.7076	−1.0192	−0.6525	−0.6426
Sales Multiplier				
Single-segment firms	0.0000	0.0000	0.0000	0.0000
Multisegment firms	−0.6675	−1.4285	−0.7750	−0.5889
Mean				
Asset Multiplier				
Single-segment firms	0.0429	−0.0095	0.0795	0.0578
Multisegment firms	−0.5864	−0.8581	−0.6815	−0.6506
Sales Multiplier				
Single-segment firms	0.0158	−0.2018	−0.0640	0.0381
Multisegment firms	−0.5705	−1.2665	−0.8737	−0.5986
Number of Observations[a]				
Single-segment firms	1,481	134	400	1,313
Multisegment firms	474	113	71	93

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

−0.5705 using the sales multiplier. Table 3 suggests that integration or diversification decreases value most noticeably in the wholesale sector and least in the processing sector. However, these are only preliminary indications of the effect of integration and diversification on firm value.

Results

The first section discusses the results from the exogenous model and the second section discusses the results from the endogenous model.

Exogenous Integration and Diversification Model Results

Exogeneity assumes that the independent binary variables for integration are not influenced by the other independent variables. This suggests, for example, that positive coefficients on the binary variables in the model lead to increases in value. The coefficients from the estimation of the model with exogenous integration are shown in Table 4 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.

In every sector except the wholesale sector, the coefficient on log of assets ($X_{1,i,t}$) is negatively and significantly related to 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 must 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 value by 0.0041% for food processing firms using the asset multiplier.[2] This indicates that asset size has a positive effect on firm value, which is expected.

[2] 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 (weighted mean of this variable for both single segment and multi-segment firms) for firms in the processing sector the total effect of the natural log of assets on value can be found as follows:

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

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

Table 4. Exogenous Integration and Diversification Model Results 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)
Ln(Assets)	−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)
Profitability	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)
Growth	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)
Leverage	−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)
Ln(Assets)	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)
Family[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
VI-Processing	n/a[b]	n/a	−1.0584***	−1.3672***	−0.7319***	−0.9027***	−0.5825***	−0.5907***
			(0.0400)	(0.0516)	(0.0419)	(0.0496)	(0.0559)	(0.0615)
VI-Wholesale	−0.8303***	−0.9645***	n/a	n/a	−1.1601***	−1.2258***	−0.9353***	−0.7907***
	(0.0768)	(0.0850)			(0.0324)	(0.0383)	(0.0801)	(0.0882)
VI-Retail	−0.2094	−0.0823	−0.9171***	−1.1156***	n/a	n/a	n/a	n/a
	(0.1770)	(0.1958)	(0.0317)	(0.0408)				
VI-Restaurant	−0.7567***	−0.7227***	n/a	n/a	n/a	n/a	n/a	n/a
	(0.0536)	(0.0594)						
Diversification	−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)
HI	−0.8053***	−0.7474***	−0.3640***	−0.7555***	−0.6123***	−0.5182***	n/a	n/a
	(0.0300)	(0.0332)	(0.0584)	(0.0752)	(0.1524)	(0.1801)		
Diversification-HI	−0.9893***	−0.9422***	n/a	n/a	n/a	n/a	n/a	n/a
	(0.0574)	(0.0635)						

Table 4. Continued

	Processing	Wholesale	Retail	Restaurant				
	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier	Asset Multiplier	Sales Multiplier
VI-Production	−0.4529*** (0.0820)	−0.7538*** (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 are the parameter estimates adjusted using Halvorsen and Palmquist's (1980) and Kennedy's (1981) method.
[b] n/a is not applicable, ***significant at the 1% level, **significant at the 5% level, *significant at the 10% level.

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 expected. For example, for a one unit increase in EBIT over sales ($X_{2,i,t}$), value using the sales multiplier increases by 0.0416% for restaurant firms.[3] A one unit increase in capital expenditures over sales ($X_{3,i,t}$) increases value by 0.0185% for processing firms when the asset multiplier is used. The parameter estimate for $X_{3,i,t}$ (0.3048 from Table 4) is multiplied by the weighted mean of this variable (0.0607) to get 0.0185. Capital expenditures over sales ($X_{3,i,t}$) include new assets, which would presumably increase profitability and lead to an increase in firm value. An increase in EBIT over sales ($X_{2,i,t}$) 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 ($X_{2,i,t}$) and capital expenditures over sales ($X_{3,i,t}$).

The coefficient on debt to asset ratio ($X_{4,i,t}$) is positive and significant for both the restaurant and wholesale sectors 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 value using the sales multiplier by 0.0427% for restaurant firms. The parameter estimate for $X_{5,i,t}$ (0.1338 from Table 4) is multiplied by the weighted mean of this variable (0.319) to get 0.0427. Leverage is usually thought to have a negative effect on firm value but large restaurant chains that carry a large amount of debt

[3] 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 for the sales multiplier is 0.0388 (weighted mean of this variable for both single segment and multi-segment firms), the effect of EBIT over sales on value can be found as follows:

$$\ln(V/IV) = \gamma_2(EBIT/Sales)$$
$$\partial \ln(V/IV)/(\partial(EBIT/Sales)/(EBIT/Sales))$$
$$= \gamma_2 * (EBIT/Sales)$$
$$= 1.0700*0.0388 = 0.0416.$$

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 show the adjusted coefficients for $X_{6,i,t}$ for each sector and multiplier. Table 4 indicates that a firm being family-controlled increases value using the asset multiplier by 23.69% for processing firms.

Calculation of the Premium or Discount

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 5, 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% level. The regression coefficients are the increases or decreases in value relative to the mean 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% premium 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 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.

In the model using the asset multiplier, vertical integration into the wholesale sector ($D_{2,i,t}$) results in a 0.73% premium for processing firms (Table 5). 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 diversification ($D_{5,i,t}$) using both multipliers and the smallest premiums are for

Table 5. 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%
VI-Processing	n/a[a]	n/a	0.06%[b]	7.41%	2.13%	−0.62%	2.41%	1.56%
VI-Wholesale	0.73%[c]	0.06%	n/a	n/a	−1.27%	1.45%	0.37%	0.80%
VI-Retail	3.39%	1.45%	−0.08%	2.33%	n/a	n/a	n/a	n/a
VI-Restaurant	1.04%	0.44%	n/a	n/a	n/a	n/a	n/a	n/a
Diversification	4.00%	1.48%	−0.64%	−18.83%	3.74%	−3.16%	2.43%	2.04%
HI	0.84%	0.40%	−0.60%	−4.93%	3.08%	−3.08%	n/a	n/a
Diversification-HI	0.05%	0.09%	n/a	n/a	n/a	n/a	n/a	n/a
VI-Production	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 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 0.06% premium 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 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.

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

diversification and horizontal integration pursued jointly ($D_{7,i,t}$).

Overall, the results from the models with exogenous integration and the 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. To further investigate the effects, it is important to determine if integration decisions should be considered endogenous instead of exogenous (i.e., the integration decisions may not be independent of the firm effects).

Endogenous Integration and Diversification Model Results

Table 6 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. The cells with positive and negative signs indicate the signs of the significant lambdas. The individual lambdas are reported in Dorsey (2006) for each combination.

If lambda is significant in the second stage of Heckman's two step procedure, this indicates that the specific integration strategy that is in the model is endogenous. This means that it is correlated with the firm characteristics that influence 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 (i.e., dark shaded cells). 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 (i.e., lighter shaded cells). When lambda is negative and significant, the firm characteristics that cause firms to diversify or integrate are negatively correlated with firm value and the discount turns to a premium. When lambda is positive and significant, the firm characteristics that cause firms to diversify or integrate are positively correlated with firm value and 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 exogenous results become premiums. This is the case of wholesale firms that are pursuing horizontal integration.

Table 6. 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
VI-Processing	n/a[a]	n/a		+			—	—
VI-Wholesale	+[b]	+[c]	n/a	n/a			+	+
VI-Retail	[d]		+		n/a	n/a	n/a	n/a
VI-Restaurant		—[b]	n/a	n/a	n/a	n/a	n/a	n/a
Diversification	—	—			—	—	+	+
HI			—	—	n/a	n/a	n/a	n/a
Diversification-HI	—		n/a	n/a	n/a	n/a	n/a	n/a
VI-Production		—		—		+		
VI-Processing	—		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.

The results suggest that this type of horizontal integration strategy leads to a premium, on average. Ingles Markets is an example of a firm with this strategy whereby they began supplying food to restaurants as well as retail supermarkets. Thus, the firm effects such as growth, profitability, and size are correlated with their decision to integrate or diversify.

Table 6 shows three cases in which characteristics that cause firms to diversify or integrate are positively correlated with firm value and the premiums from the exogenous results turn to discounts using both multipliers. 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 one case where lambda is positive. For example, 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. Vertical integration into wholesale by processing firms is another example. For example, Con Agra Foods integrated into wholesaling operations but later divested these operations. Another case is diversification by restaurant firms where Frisch's (owners of Golden Corral Restaurants) Restaurants diversified into hotels and later sold this operation. These examples suggest that management may have realized this type of activity was having a negative effect on firm value. In other words, the firm effect variables such as growth, profitability, and size for these three firms are correlated with the decision to divest the integrated or diversified operation. The results suggest that this type of activity is causing a discount during this time period, on average.

Conclusions and Implications

This is the first research to quantify the premium or discount from integration and diversification strategies pursued by agribusiness and food business firms. In general, integration strategies used by processing firms had a premium associated with integration. This corresponds with the increase in integration observed in production agriculture. However, efforts by wholesalers to integrate into restaurants and processing have led to discounts. The role of contracting between producers and processors is increasing in agriculture. It is evident from this research that processors are also seeking to integrate further towards retail supermarkets.

The managerial implications from this study include the fact that larger firms, as measured by asset size, have premiums which may be due to lower fixed costs due to economies of scale, lower variable costs due to economies of size, or better negotiating ability. Diversification outside of the food economy does not lead to premiums while integration within the food economy does lead to premiums in certain situations. Managers who seek to diversify should analyze this strategy carefully.

Future research might seek to incorporate this form of vertical coordination into a framework for empirical research. Sykuta and James (2004) indicate that the Contracting and Organizations Research Institute at the University of Missouri has over 11,000 contract documents. The food business and agribusiness contracts could be matched with the firms used in this research to include this form of vertical coordination. Future research using case studies, with the unit of analysis being the firm pursuing the different types of integration or diversification strategies found here, could help researchers better understand the motivation for the types of strategies identified by Hennessy (1996) and quantify them into the three theories on vertical coordination.

Most research has focused on the interface between producers and processors in the marketing system. The food economy is a large component of the U.S. economy and a better understanding of trends in coordination between these participants beyond the farm gate can help better explain why coordination is increasing at the interface between producers and processors. Food processors are closest to the producer and it may be that these premiums from integration towards retail supermarkets in the food economy are causing processors to consider similar coordination strategies for production agriculture.

[Received August 2008; Accepted March 2009.]

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