Diversification and Firm Performance in the Food Economy

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The food economy is an important and unique part of the US economy (Kinsey). The performance of the food economy and the firms that operate in it are regularly described by widely read publications such as Business Week, Fortune, and Forbes. Food economy firms are uniquely different relative to other businesses. Sonka and Hudson identified the following five factors that make the food economy unique from other industries: the uniqueness of food for political and cultural reasons; uncertainty arising from the underlying biologic basis of crop and livestock production; the level of political intervention; institutional arrangements that place significant portions of the technology development process in the public sector; and differing competitive structures existing in the food economy.[1]

Many food economy firms are widely diversified. Various explanations have been offered for this diversification. Many supply chains handling agricultural commodities have similar marketing, transportation, and processing characteristics which create economies of scope and leads to related diversification. Processors with consumer food brands may seek to extend their branding to other related and unrelated food products. For example, Cotterill notes that food retailers may be able to achieve economies of scope in establishing a retail brand. Lubatkin et al. analyzed three horizontal mergers in the food processing industry and found that economies of scope in marketing might help explain recent diversification efforts.

Our objective is to analyze the value of diversification in the food economy and it's four distinct sectors**;** food processing, wholesale grocery, retail supermarket, and restaurant.[2] Prior research analyzing the value of diversification has focused on the US economy as a whole and has suggested that diversified firms are valued at a discount compared to single-segment firms. This study addresses the value of diversification with a more narrow focus, the food economy, rather than the entire economy as in previous research.

Overview of Diversification and Firm Value Literature

Theoretical arguments suggest that diversification can have both positive and negative effects on firm value. In general, the earlier research (prior to 1980) focused on the benefits of diversification while the most recent (post 1980) literature addresses the costs of diversification.

Potential Benefits of Diversification

Gains from diversification may arise from various sources. Economies of scope and managerial economies of scale can provide gains from diversification (Chandler). Wernerfelt and Montgomery suggest that firm-specific resources can be utilized in multiple industries and contribute to gains from diversification.

Another theoretical argument for diversification relates to capital markets and resource allocation. The desire by firms to diversify and form internal capital markets reflects the idea that information held by managers of firms and the external capital market is asymmetric. Managers of firms have information advantages over the external capital market and therefore internal capital markets of diversified firms allocate resources more efficiently than external capital markets (Williamson, Stein). Weston suggests that internal capital markets of diversified firms are more efficient than external capital markets. Stulz extended this argument with the concept that diversified firms create larger internal capital markets and reduce the problem of underinvestment. According to this argument, segments of diversified companies invest in more positive net present value opportunities than comparable single segment firms.

Managers may have incentives to diversify and increase firm size even if it reduces shareholder wealth. Management motivation for mergers include risk reduction (Amihud and Lev), greater power and prestige (Jensen and Stulz), and managerial compensation (Jensen and Murphy). Diversification reduces risk of a manager's portfolio when multiple segments of a firm have imperfectly correlated earnings (Lewellen). In addition managerial compensation tends on average to be positively correlated with firm size, providing managers an incentive to increase firm size through diversification (Jensen and Murphy).

Potential Costs of Diversification

The literature also suggests that diversification may reduce shareholder wealth. Diversification can lead to inefficient cross-subsidization of poor performing business segments by profitable divisions within the same firm (Meyer, Milgrom, and Roberts). Jensen argues that an unprofitable business segment which is part a diversified firm invests in more negative net present value projects than their segments likely would as independent firms. Diversified firms have information asymmetry between corporate and division management creating higher administrative costs for diversified firms as compared to single segment firms (Harris, Kreibel, and Ravis; Myerson).

Related and Unrelated Diversification

Prior research has also shown that the effect of diversification on firm value depends on the type of diversification (Rumelt; Christensen and Montgomery; and Palepu). Diversification is related if it involves business segments that 1) are components of the same supply chain (vertical coordination), 2) supply similar markets, 3) use similar distribution systems, 4) posses similar production technologies, or 5) engage in similar research and development (Salter and Weinhold). Results from prior studies have shown that firms that are diversified into related businesses were usually more profitable than other firms (Christensen and Montgomery; Palepu; and Rumelt). Economies of scope may exist in some industries that allow firms to gain from diversifying in related activities as opposed to unrelated activities. Diversification in related activities has a larger positive effect on firm value than unrelated diversification since human capital and other resources (economies of scope) can be used in related markets.

Similarly, a high quality reputation and branding in one market may be carried over to another related market which provides positive net benefits to the firm (Nayyar). For example, Starbucks Corporation buys roasts whole bean coffees and sells them along with rich, specialty coffees, pastries and confections, and coffee-related accessories and equipment through company-operated retail stores. It also sells premium coffee beans through other channels of distribution, including coffee distributors, hotels, retailers, warehouse clubs, and restaurants; which are collectively called Specialty Operations. Starbucks has essentially exploited economies of scope, managerial economies of scale, and its reputation for delivering high quality premium coffee in their retail stores to expand sales in their Specialty Operations. Product characteristics, industry organization, and market structure may therefore affect the ability of firms to add value through diversification.

Theoretical Models

Our analysis of the effects of diversification on firm value is based on a measure of excess value for both single segment and multi-segment firms. In our measure of excess value we use the ratio of actual value of a firm to its imputed value. We follow Berger and Ofek and model excess value (*EXV*) as:

(1) $EXV=\ln(MV/IV)$,

where ln is the logarithmic operator, *MV* is the sum of the market value of equity and the book value of debt, and *IV* represents the sum of the imputed values for each individual business segment (herein after referred to as segment). For our study, a segment is defined as the portion of a company's operations that are reported under a single four-digit US Department of Commerce Standard Industrial Classification (SIC) industry code. A firm may have operations in multiple industries and therefore report results for more than one segment.[3] The sum of the imputed values of a firm are derived using the industry multiplier approach as developed by Berger and Ofek. We multiply the segment assets of each firm by the median market value of equity plus the book value of debt-to-asset ratio of single segment firms within the same industry (same four-digit SIC code). The sum of all the imputed values of a multi-segment firm is the imputed value of the entire firm as if each segment is operating as a stand-alone business. If *MV* is greater than *IV* then excess value is positive (negative) and the market perceives the value of the firm to be greater (less) than the sum of the imputed value of its individual segments. Using the same methodology, in addition to using assets as a multiplier we also use total sales to compute *EXV* for each firm.

We investigate the effects of diversification on firm value using three different models. Model 1 investigates the effects of diversification on excess value while controlling for firm characteristics which follows directly from Berger and Ofek. Model 2 is a modification of Model 1 where year binary variables and additional firm characteristics are added; and the effects of diversification and firm characteristics are allowed to vary by sector. A third (Self-selection) model is developed which is a modification of Model 2 by treating the decision to diversify as endogenous rather than exogenous.

Model 1: Benchmark Model with Diversification Measured Exogenously

First we estimate firm excess value using Berger and Ofek's model:

(2) $$EXV_{i,t} = \beta_0 + \beta_1 Y_{i,t} + \beta_2 X_{i,t} + e_{i,t} ,$$

where $EXV_{i,t}$ is the excess value of firm *i* in year *t*; $X_{i,t}$ is a set of firm characteristics; $Y_{i,t}$ is a binary variable equal to one if firm *i* in year *t* is diversified, 0 otherwise; β_0, β_1, and β_2 are parameters to be estimated; and $e_{i,t}$ is the error term. The set of firm characteristics are those used by Berger and Ofek and include the natural log of total assets, earnings before interest and taxes divided by total sales, and capital expenditures divided by sales.

In this model we analyze how the level of firm value varies with firm structure ($Y_{i,t}$), while controlling for size, profitability, and capital expenditures. We assume diversification is exogenous to the firm which provides a benchmark for comparing results with differences in estimates due to differences in data sets. This model or variations of it have been used by Campa and Kedia; Denis, Denis, and Yost; and Mansi and Reeb.

Model 2: Diversification Measured Exogenously with Firm and Diversification Effects Varying by Sector

We develop a second model which is a modification of the previous model by first adding additional variables to the set of firm characteristics, a set of sector binary variables for diversified firms rather than just one diversified variable, and a set of year dummy variables. In the set of firm characteristics we include a measure for leverage and a quadratic term for size which results in the following model:

$$(3) \qquad EXV_{i,t} = \beta_0 + \beta_{1j} Y_{i,t} IND_{i,t} + \beta_2 X_{i,t} + \delta_t YR_{i,t} + \eta_{i,t},$$

where $IND_{i,t}$ is a binary variable equal to one if firm *i* in year *t* is in sector *j*, for *j*=1 to 4 (i.e., processing, wholesale, retail, restaurant), 0 otherwise; $YR_{i,t}$ is a binary variable equal to one if firm *i* is in year *t*, 0 otherwise; β_0, β_{1j}, β_2 and δ_t, are parameters to be estimated; $\eta_{i,t}$ is the error term; and all other variables are as previously specified.

We use total debt divided by assets as a measure of leverage. According to finance theory, leverage has a negative effect on firm value, therefore we hypothesize that the parameters on leverage to be negative. We include a quadratic size term since this effect may be nonlinear due to decreasing marginal returns. We also hypothesize that the effect of diversification on excess firm value varies by sector. The parameter $\beta_{1,j}$ provides a measure of the effect of diversification on firm value that can vary by sector. For example in this model, a diversified firm within the processing sector may have larger positive diversification effects due to greater opportunities for economies of scope as compared to the wholesale, retail, and restaurant sectors. Specifically, food processors may have engaged in horizontal mergers during the 1980s to ensure and enhance their performance and value in reaction to the increasing consolidation in the food retailing industry (Connor and Geithman).

Lang and Stulz have shown that industry effects explain part of the discount of diversified firms. We use two digit SIC codes to assign firms to one of four sectors; processing (SIC 20), wholesale (SIC 51), retail (SIC 54), and restaurant (SIC 58). We use the term sector rather than industry to measure industry effects. For example, the processing sector contains numerous food processing industries which are defined as four digit SIC codes. Firms with segments in different sectors are assigned to the sector which makes up the largest portion of their sales. The year dummy variables measure the effect of macroeconomic conditions and the business cycle on the excess value of a firm.

We further expand the model specified in equation (3) to consider that the effects of size, profitability, capital expenditure divided by sales, and leverage on excess firm value may vary by sector which results in the following Model 2.

(4) $$EXV_{i,t} = \beta_0 + \beta_{1j} Y_{i,t} IND_{i,t} + \beta_{2j} IND_{i,t} X_{i,t} + \delta_t YR_{i,t} + \upsilon_{i,t},$$

where β_{1j} and β_{2j} varies by sector; $\upsilon_{i,t}$ is the error term, and all other variables are as previously specified. The parameters on the set of firm characteristics are now specific to a sector. For example, this specification allows for the size effect to vary by sector, so the size effect may be larger for the processing sector as compared to the restaurant sector. The food processing sector has more industries (defined by 4 digit SIC codes) that are similar and use similar supply chains as compared to the restaurant sector.

Model 3: Diversification Measured Endogenously with Firm and Diversification Effects Varying by Sector

In our third model, we treat the decision to diversify as endogenous rather than exogenous and control for the self-selection of firms that diversify using Heckman's two-stage procedure.[4] This self-selection model takes into account firm characteristics that both lead firms to diversify and affect firm value. Prior research has show that firm and industry characteristics influence a firm's decision to diversify (Maksimovic and Phillips; Lang and Stulz).

In the first step we estimate a firm's decision to diversify as a function of firm, industry, and macroeconomic conditions:

(5) $$Y_{i,t}* = \alpha \mathrm{w}_{\mathrm{i,t}} + u_{i,t},$$

(6) $$Y_{i,t} = 1 \text{ if } Y_{i,t}* > 0, \text{ 0 otherwise},$$

where $Y_{i,t}^{*}$ is not observed, $w_{i,t}$, is a set of industry and firm characteristics that affect a firm's decision to diversify, α represents a vector of parameters to be estimated, and $u_{i,t}$ is the error term. We assume that $e_{i,t}$ (equation 2) and $u_{i,t}$ have a bivariate normal distribution with zero means, correlation ρ, and standard deviation σ_{ε}. To model excess value for firms who choose to diversify we use:

(7) $$E[EXV_{i,t} \mid Y_{i,t} = 1] = \beta_0 + \beta_1 Y_{i,t} + \beta_2 X_{i,t} + \rho\sigma_{\varepsilon}\lambda_1(\alpha w_{i,t}),$$

where E is the expectation operator; $\lambda_1 = \dfrac{\phi(\alpha w_{i,t})}{\Phi(\alpha w_{i,t})}$; $\phi(.)$ and $\Phi(.)$ are, respectively, the density and cumulative distribution functions of a standard normal variable; and $\beta_{0,}$ $\beta_{1,}$ and β_2 are parameters to be estimated. The last term in equation (5) is the expected value of the error term in equation (3), $E(\eta_{i,t} \mid Y_{i,t} = 1)$. For firms who do not diversify, the excess value is modeled by:

(8) $$E[EXV_{i,t} \mid Y_{i,t} = 0] = \beta_0 + \beta_2 X_{i,t} + \rho\sigma_{\varepsilon}\lambda_2(\alpha w_{i,t}),$$

where $\lambda_2 = \frac{-\phi(\alpha w_{i,t})}{1-\Phi(\alpha w_{i,t})}$.

The difference between the expected excess value between multi-segment and single-segment firms is then,

$$E[EXV_{i,t} \mid Y_{i,t}=1] - E[EXV_{i,t} \mid Y_{i,t}=0] = \beta_1 + \rho\sigma_\varepsilon \left[\frac{\phi(\alpha w_{i,t})}{\Phi(\alpha w_{i,t})(1-\Phi(\alpha w_{i,t}))} \right]. \tag{9}$$

This difference is what is estimated by the least squares parameter on the segment binary variable in equation (2). Therefore least squares overestimates (underestimates) the effect of being diversified on the excess value of a firm if ρ is positive (negative).

In the first step of Heckman's two-step procedure using the entire sample we estimate equation (5) with a probit model to obtain estimates of α and compute $\hat{\lambda}_{i,t}$ for each observation. Then we estimate the excess value of a firm using the following model:

$$EXV_{i,t} = \beta_0 + \beta_1 Y_{i,t} + \beta_2 X_{i,t} + \rho\sigma_\varepsilon[\lambda_1(\alpha_{i,t})Y_{i,t} + \lambda_2(\alpha_{i,t})(1-Y_{i,t})] + \zeta_{i,t}, \tag{10}$$

which simplifies to

$$EXV_{i,t} = \beta_0 + \beta_1 Y_{i,t} + \beta_2 X_{i,t} + B_\lambda \lambda_{i,t} + \zeta_{i,t}, \tag{11}$$

where $\beta_\lambda = \rho\sigma_\varepsilon$ and $\zeta_{i,t}$ is the error term. Since β_λ is a product of σ_ε and the correlation between the error terms $\varepsilon_{i,t}$ and $u_{i,t}$, the sign is determined by ρ. If the characteristics that make firms choose to diversify are positively (negatively) correlated with firm value, then both ρ and β_λ are positive (negative).

To allow the effects of diversification and firm characteristic to vary by sector we modify equation (11) which results in the following Model 3:

$$EXV_{i,t} = \beta_0 + \beta_{1j} Y_{i,t} IND_{i,t} + \beta_{2j} IND_{i,t} X_{i,t} + B_\lambda \lambda_{i,t} + \zeta_{i,t}, \tag{12}$$

where β_{1j}, and β_{2j} now vary by sector and all other parameters are as previously specified. This model treats the decision to diversify as endogenous and allows the effects of diversification and firm characteristics to vary by sector.

Data

Data for this study are obtained from the Standard and Poors Compustat Business-Segment Reports for business segments in the food economy for the 1983 to 2002 time period. The business segment reports contain data on segment sales, assets, and earnings before interest and taxes each segment. We obtain firm level sales for firms that have segments in the food economy for the same time period. To be included in our final sample, multi-segment firms must have data available at both the firm and segment levels. This results in a preliminary sample of 4,178 observations that have both segment and firm level data.[5] Sales at the firm level are usually completely allocated among the reported segments of a diversified firm; however assets are not always completely allocated among segments of a diversified firm. The segment sum of assets is sometimes less than the firm figure which results in unallocated assets. We follow the method used by Berger and Ofek to deal with this problem. If the sum of the segment assets differ from the firm reported figure by more than 25% we exclude the observation from our analysis. If the deviation is within 25%, we adjust the imputed value by the percentage deviation between the sum of its segment assets and the reported total firm assets. We deal with sum of segment sales as compared to the reported total firm figure in the same manner. This procedure leaves us with a sample of 475 firms with 3,151 observations, of which 198 are diversified. Within the multi-segment observations (diversified firms), 174 have two segments and the average number of segments per diversified firm is 2.2.

Excess Value

The excess value measure we calculate using the asset and sales multiplier are reported in Table 1. We find that multi-segment firms have a discount (lower excess firm value) relative to single-segment firms with a median discount of 4.2 percent using the asset multiplier and 15.8 percent using the sales multiplier. Berger and Ofek reported median discounts of 16.2 percent using asset multiples and 10.6 percent using sales multiples. Since our data set is the food economy as compared to the entire economy, the diversification in our data is primarily related diversification, which may explain why our discount is smaller than that reported by Berger and Ofek. This is consistent with prior research which has shown that related diversification in food firms is positively related to stock market evaluation of firm performance (Ding, Caswell, and Zhou).

In Table 2 we report median and means excess value by the four major sectors in the food economy. Within each sector, multi-segment firms are larger in terms of average assets, market value, and sales. Additionally, within each sector, the average income to sales ratio is higher for multi-segment firms as compared to single-segment firms. For the wholesale, retail, and restaurant sector, the capital expenditures to sales ratio is higher for multi-segment firms as compared to single-segment firms. The leverage ratio is higher for multi-segment firms as compared to single-segment firms in the processing, wholesale, and retail sectors.

Empirical Models

We estimate three empirical models which correspond to the previously described theoretical models.

Model I

The first model we estimate using OLS correspond to the theoretical model in equation (2) and is specified as follows:

(13) $$EXV_{i,t} = \beta_0 + \beta_{11} X_{1,i,t} + \beta_{12} X_{2,i,t} + \beta_{13} X_{3,i,t} + \beta_2 Y_{i,t} + \eta_{i,t},$$

where $EXV_{i,t}$ is the sum of the market value of equity and the book value of debt divided by the sum of the imputed values for each individual business segment. The independent variables are identified and defined in table 3.

Model II

The second model that we estimate, Model II, is consistent with the theoretical model in equation (4) and is specified as follows:

(14)

$$\begin{aligned} EXV_{i,t} = {} & \beta_0 + \beta_1 Y_{i,t} + \beta_{11} PR_{i,t} Y_{i,t} + \beta_{12} WH_{i,t} Y_{i,t} + \beta_{13} RS_{i,t} Y_{i,t} + \\ & \beta_{21} X_{1,i,t} + \beta_{22} X_{2,i,t} + \beta_{23} X_{3,i,t} + \beta_{24} X_{4,i,t} + \beta_{25} X_{5,i,t} + \\ & \beta_{31} X_{1,i,t} PR_{i,t} + \beta_{32} X_{2,i,t} PR_{i,t} + \beta_{33} X_{3,i,t} PR_{i,t} + \beta_{34} X_{4,i,t} PR_{i,t} + \beta_{35} X_{5,i,t} PR_{i,t} + \\ & \beta_{41} X_{1,i,t} WH_{i,t} + \beta_{42} X_{2,i,t} WH_{i,t} + \beta_{43} X_{3,i,t} WH_{i,t} + \beta_{44} X_{4,i,t} WH_{i,t} + \beta_{45} X_{5,i,t} WH_{i,t} + \\ & \beta_{51} X_{1,i,t} RS_{i,t} + \beta_{52} X_{2,i,t} RS_{i,t} + \beta_{53} X_{3,i,t} RS_{i,t} + \beta_{54} X_{4,i,t} RS_{i,t} + \beta_{55} X_{5,i,t} RS_{i,t} + \\ & \sum\nolimits_{t} \delta_t YR_{i,t} + \upsilon_{i,t}, \end{aligned}$$

where *t* represents years 1984 to 2002. In this model we use the retail sector as the default for all sector binary variables; therefore β_1 represents the effect of diversification on the excess value for retail firms and the sum of the coefficients $(\beta_1 + \beta_{11})$ represents the fixed effect of diversification on the excess value of processing firms. Similarly, the coefficient β_{22} measures the effect of profitability on the excess value of retail firms and the sum of the coefficients $(\beta_{22} + \beta_{32})$ measures the effect of profitability on the excess value of processing firms.

Model III

To model excess value we modify equation (14) by adding the self-selection variable, $\lambda_{i,t}$, and the corresponding parameter, B_{λ} and estimate using OLS. We calculate marginal effects for the probit model for the variables $x_{1,i,t}$ $x_{2,i,t}$ $x_{3,i,t}$ $x_{4,i,t}$ and $x_{5,i,t}$ at mean values for continuous and binary year variables; and sector binary variables set to zero. We also calculate marginal effects for variables $x_{1,i,t}PR_{i,t}$, $x_{2,i,t}PR_{i,t}$, $x_{3,i,t}PR_{i,t}$, $x_{4,i,t}PR_{i,t}$, and $x_{5,i,t}PR_{i,t}$ at mean values for continuous and year binary variables; sector binary variable $PR_{i,t}=1$; and $WH_{i,t}=0$ and $RS_{i,t}=0$. Marginal effects for variables $x_{1,i,t}WH_{i,t}$, $x_{2,i,t}WH_{i,t}$, $x_{3,i,t}WH_{i,t}$, $x_{4,i,t}WH_{i,t}$, $x_{5,i,t}WH_{i,t}$, $x_{1,i,t}RS_{i,t}$, $x_{2,i,t}RS_{i,t}$, $x_{3,i,t}RS_{i,t}$, $x_{4,i,t}RS_{i,t}$, and $x_{5,i,t}RS_{i,t}$ are calculated similarly. To calculate the marginal effect for $PR_{i,t}$ we use the following equation:

(14) $$F(xb)^{*} - F(xb)^{**},$$

where $F(xb)^{*}$ is the cumulative probability density function evaluated at mean values for continuous and year binary variables, $PR_{i,t}=0$, $WH_{i,t}=0$, and $RS_{i,t}=0$; and $F(xb)^{**}$ is the cumulative probability density function evaluated at mean values for continuous and year binary variables, $PR_{i,t}=1$, $WH_{i,t}=0$, and $RS_{i,t}=0$. Marginal effects for $WH_{i,t}$ and $RS_{i,t}$ are calculated similarly.

Results and Discussion

Table 4 reports the results of three estimations of excess firm value. The results and discussion are presented for each model.

Model 1 Results: Benchmark Model with Diversification Measured Exogenously

Model 1, which measures diversification the broadest and is our benchmark measure, is estimated using equation (13). The results indicate that the diversification binary variable $Y_{i,t}$ has a negative effect on firm value with an estimate of -0.03 which is smaller in absolute value than Berger and Ofek's estimate of -0.13. Our lower estimate may be due to differences in data sets. Our data set is the food economy with related diversification and a longer time period as compared to Berger and Ofek's data set which contained firms consisting of the entire economy having both unrelated and related diversification for years 1986 to 1991. Parameter estimates for profitability and capital expenditure to sales ratio are positive and significant at the 0.001 level of significance.

Model 2 Results: Diversification Measured Exogenously with Firm and Diversification Effects Varying by Sector

In table 4, Model 2 is the empirical model that is specified in equation (14). This model allows for both, effects of diversification and firm characteristics, to vary by sector; and includes year binary variables. In this model the effect of diversification on excess firm value is -0.20 and significant at the 0.05 level of significance. This fixed diversification effect applies to the retail sector since it is the default. The processing sector fixed effect of diversification is the sum of two parameters ($\beta_1 + \beta_{11}$ or -0.20 + 0.25) which results in a net premium of 0.05. The restaurant sector also has a net positive fixed effect of diversification of 0.23, which is the sum of two parameters ($\beta_1 + \beta_{13}$ or -0.20 and 0.43). The effect of the natural log of assets on excess firm value is significantly different for retail and processing firms with effects of -0.22 and -0.13 ($\beta_{21} + \beta_{31}$ or -0.22 + 0.09), respectively.

In all sectors, the elasticity of excess value with respect to assets (rather than the natural log of assets) is negative with estimates of -0.1761, -0.1053, -0.1785 and -0.1763 for the retail, processing, wholesale and restaurant sectors, respectively. The results indicate that the effects of profitability for the processing, wholesale, and restaurant sectors are significantly different than the retail sector. Within the retail sector, profitability has a large positive effect on excess value with an estimate of 10.26 as compared to the net effect of 1.18, 0.60, and 2.39 for the processing, wholesale, and restaurant sectors, respectively.

Model 3 Results: Diversification Measured Endogenously with Firm and Diversification Effects Varying by Sector

Table 5 reports results for the first stage of the self-selection model. The independent variables included in Model 2 are included in the first stage of Model 3, except now the binary diversification variable, $Y_{i,t}$ is the independent variable. We report the marginal effects of the explanatory variables in addition to the parameter estimates and standard errors. The processing and restaurant sector binary variables are found to be significant in the decision to diversify. Firms in the processing sector are more likely to diversify than firms in the retail or restaurant sectors. Restaurant firms are less likely to diversify than firms in the retail sector.

We also calculate the marginal effect of a one unit change in assets (rather than a one unit change in the natural log of assets) on the decision to diversify at mean values for explanatory variables. It is estimated that an increase in assets by one million dollars increases the probability of diversification by 0.01, 0.04, and 0.21 for firms in the retail, wholesale, and restaurant sectors, respectively. In contrast, an increase in assets by one million dollars has a negative effect of -0.01 on the probability of diversification for processing firms. Fifteen out of the nineteen year binary variables are found to be significant at 0.10 or less, suggesting that macroeconomic conditions have an impact on a firm's decision to diversify.

The results from the second stage of the self-selection model are reported in table 4. Similar to Campa and Kedia, we find a diversification premium when modeling the decision to diversify as endogenous. Our results indicate that a firm's decision to diversify and excess firm value are negatively correlated with an estimate of -0.33 for B_λ. With the retail sector as the default, the effect of diversification on excess value is estimated to be 0.47, which is contrasting to the Model 2 estimate of -0.20. The fixed effects of diversification for the processing and wholesale sectors are not found to be significantly different than the retail sector. However, the fixed effect of diversification in the restaurant sector is found to be significantly larger than the retail sector.

Similar to Model 2, the effect of profitability on excess value in the retail sector is larger compared to the other three sectors. The effect of earnings before interest and taxes on excess value in the retail, processing, wholesale, and restaurant sectors are estimated to be 10.28, 1.20, 0.59, and 2.39, respectively, which are similar to the estimates in Model 2. The capital expenditures to sales ratio and leverage have significant negative effects on excess value with estimates of -0.50, and -0.05, respectively. The effect of capital expenditures on excess value is significantly different in the restaurant sector as compared to the retail sector with a positive effect of 1.64. Effects of leverage in the wholesale and restaurant sectors are found to be significantly different than the retail sector estimate of -0.05, with estimates of 0.20 and 0.19, respectively.

When comparing the results between Model 2 and Model 3, the Self-selection model, the estimates are quantitatively similar, except for the diversification effects. In the Self-selection model the diversification effects are positive with estimates of 0.47, 0.69, 0.26, and 0.89 for the retail, processing, wholesale, and restaurant sectors, respectively. In Model 2, these were negative for the retail and wholesale sectors. Since the estimate for B_{λ} is found to be significant at the 0.001 level, we conclude that the related diversification in the food economy that we observe in our data has a positive impact on excess value.

Conclusion

Consistent with the general consensus of prior research, we find that firms in the food economy choose to diversify and related diversification enhances firm value. Besanko et al. noted that firms who diversify according to a core set of resources and integrate the business that is being acquired tend to outperform firms that are not able to achieve these synergies between diversified businesses units. This suggests that these successful firms are able to achieve economies of scope which allow them to reduce transactions costs and make it efficient to organize diverse business units within one business. This could be the rationale for the various acquisitions carried out by Unilver (acquisition of Slim-Fast, Bestfoods, and Ben and Jerry's), Pepsico (acquisition of Quaker Oats), General Mills (acquisition of Pillsbury), and other similar firms in the food economy. The reduction of transactions costs through diversification suggests that these diversified firms may be more profitable than single industry firms. Future research on the food economy should include further analysis of firms that are able to repeat their performance over time to determine whether diversification remains profitable in the long-run.

Processing firms are most likely to diversify which suggests greater opportunities for economies of scope or scale. The processing sector had the greatest amount of assets per firm and large and persistent sector effects which may suggest greater economies of size as well. Restaurants firms were least likely to diversify. This sector had the greatest amount of entry and exit, fewer assets, and the lowest profits relative to the other three sectors in the food economy.

The amount of leverage (debt-to-asset ratio) has a negative effect on excess value in the retail sector suggesting that increased amount of debt results in negative excess value. This finding was positive for the wholesale and restaurant sectors. The retail sector has more leverage, assets, and sales relative to the other three sectors which suggest that this sector has unique characteristics. Thus, it is important to look at individual sectors within the entire economy when evaluating the impact of diversification rather than aggregated sectors in an economy. Industry characteristics such as asset size and barriers to entry may influence whether firms in that industry choose to diversify.

There are also important implications regarding public policy for firms interested in diversifying laterally into related food industries or vertically up and down the food chain. If the market perceives diversified firms as a greater value, then there may be potential benefits associated with consolidation and merger activities in the food economy. Lastly, this research provides information for scholars in the area of the food economy and management strategy. The results from this study suggest that diversification in the food and agribusiness sectors contributes to positive excess firm value, which is relevant information to scholars and students who are interested in careers in these sectors.

Footnotes

[1] The performance of firms in the food economy are of great interest to policy makers and researchers. For example, Congress appropriated several million dollars in recent years to study various aspects of the food economy. Examples of this include research at Iowa State University (Food Chain Economic Analysis), the University of Connecticut (Food Marketing Policy Center), the University of Wisconsin (Food Systems Research Group), and the Agricultural Marketing Resource Center (Iowa State University, Kansas State University, and University of California). Similarly, the Sloan Foundation funded the Food Industry Center at the University of Minnesota to study the retail grocery sector.

[2]We refer to these four industries as processing, wholesaling, retail, and restaurant throughout the paper.

[3] For example, Nestle's corporate data is reported in SIC 2000 Food and Kindred Products. Its business segment data are reported in SIC 2023 Dry, Condensed and Evaporated Milk Products (called Milk Products by Nestle); SIC 2038 Frozen Specialties (called Prepared Dishes and Cooking Aids); SIC 2066 Chocolate and Cocoa Products (called Chocolate and Confectionary); and SIC 2095 Roasted Coffee (called Beverages). Thus, Nestle operates in the processing sector (SIC 20) and has business segments within four industries (SIC 2023, SIC 2038, SIC 2066, and SIC 2095).

[4]Further explanation and derivation of Heckman's model can be found in Greene and Maddala. Both provide an empirical model using Heckman's two-step estimation procedure.

[5] Berger and Ofek's data consisted of all industries except for the financial services industry. They eliminated observations with sales or assets near zero and any firm with sales less than 2 million.

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Table 1. Mean, Median, and Standard Deviations by Diversification Profile

	Mean	Median	Standard Deviation
Excess Value Asset Multiplier			
Single-segment firms	0.0149	0.0000	0.5640
Multi-segment firms	-0.0094	-0.0422	0.5681
Excess Value Sales Multiplier			
Single-segment firms	-0.0369	0.0000	0.6907
Multi-segment firms	-0.3005	-.01582	1.0799
Number of segments			
Single-segment firms	1.0000	1.0000	0.0000
Multi-segment firms	2.1700	2.0000	0.5013
Natural log of total assets			
Single-segment firms	4.9191	4.8889	2.2158
Multi-segment firms	7.0224	7.4760	1.9711
Income to sales Ratio			
Single-segment firms	0.0456	0.0492	0.0913
Multi-segment firms	0.0602	0.0433	0.0617
Capital expenditures to sales ratio			
Single-segment firms	0.0757	0.0458	0.0972
Multi-segment firms	0.0482	0.0375	0.0482
Leverage Ratio			
Single-segment firms	0.2897	0.2568	0.2435
Multi-segment firms	0.3377	0.3164	0.1838
Natural log of total assets squared			
Single-segment firms	29.1057	23.9018	23.0612
Multi-segment firms	53.1799	55.8906	25.4650
Market Value (millions)			
Single-segment firms	1,710.41	84.44	8,364.03
Multi-segment firms	5,139.94	890.07	10,462.17
Sales (millions)			
Single-segment firms	1,968.89	218.69	5,421.63
Multi-segment firms	6,826.88	3,486.10	8,075.77

Table 2. Median and Means for the Four Sectors in the Food Economy by Diversification Profile

	Processing	Wholesale	Retail	Restaurant
Medians				
Excess Value using Asset Multiplier				
Single-segment firms	0.0000	0.0000	0.0000	0.0000
Multi-segment firms	-0.0071	-0.2777	-0.0612	0.2615
Excess Value using Sales Multiplier				
Single-segment firms	0.0000	0.0000	0.0000	0.0000
Multi-segment firms	-0.0391	-0.5064	-0.1729	0.1932
Means				
Excess Value using Asset Multiplier				
Single-segment firms	-0.0068	-0.1283	0.0635	0.0447
Multi-segment firms	0.1202	-0.3171	-0.0144	0.1645
Excess Value using Sales Multiplier				
Single-segment firms	-0.0560	-0.2513	-0.0503	0.0248
Multi-segment firms	0.0345	-1.0798	-.03219	0.1123
Number of observations				
Single-segment firms	1292	169	414	1078
Multi-segment firms	88	53	28	29
Natural log of total assets				
Single-segment firms	5.2611	4.3495	6.3171	4.0617
Multi-segment firms	7.4387	7.1110	7.3028	5.3268
Income to sales Ratio				
Single-segment firms	0.0661	-0.0077	0.0255	0.0370
Multi-segment firms	0.0911	0.0239	0.0284	0.0635
Capital expenditures to sales ratio				
Single-segment firms	0.0652	0.0368	0.0360	0.1097
Multi-segment firms	0.0658	0.0146	0.0327	0.0711
Leverage Ratio				
Single-segment firms	0.2595	0.2846	0.3382	0.3079
Multi-segment firms	0.3189	0.3662	0.4219	0.2613
Natural log of total assets^2				
Single-segment firms	32.7743	24.4189	42.5190	20.2922
Multi-segment firms	61.0950	52.0405	55.3849	29.1154
Market Value (millions)				
Single-segment firms	2,850.70	814.84	1,651.50	542.92
Multi-segment firms	9,545.63	1,169.50	3,728.51	390.07
Sales (millions)				
Single-segment firms	2,170.26	2,148.97	5,203.80	456.98
Multi-segment firms	7,300.98	7,675.85	10,300.53	482.83

Table 3. Definition of Variables used in the Three Empirical Models

Variable	Definition
$EXV_{i,t}$	The sum of the market value of equity and the book value of debt /sum of the imputed value for each individual business segment
$Y_{i,t}$	Binary variable =1 if firm *i* in year *t* is diversified
$PR_{i,t}$[a]	Binary variable =1 if firm *i* in year *t* is in the processing sector
$WH_{i,t}$[a]	Binary variable =1 if firm *i* in year *t* is in the wholesale sector
$RS_{i,t}$[a]	Binary variable =1 if firm *i* in year *t* is in the restaurant sector
$X_{1,i,t}$	The natural log of assets of firm *i* in year *t*
$X_{2,i,t}$	Earnings before interest and taxes/Sales of firm *i* in year *t*
$X_{3,i,t}$	Capital expenditures/Sales of firm *i* in year *t*
$X_{4,i,t}$	Total Debt/Assets of firm *i* in year *t*
$X_{5,i,t}$	Natural log of assets squared of firm *i* in year *t*
$Y84_{i,t}$	Binary variable =1 if firm *i* is in year 84.
$Y85_{i,t}$- $Y02_{i,t}$	Year binary variables that can be similarly interpreted as above.

[a]Diviersified firms are assigned to the sector which has the largest portion of sales.

Table 4. Parameter Estimates for the Three Models with Excess Value as the Dependent Variable

Variable	Model 1	Model 2	Model 3[b]
		Parameter Estimates	
Intercept	-0.1311 ***	0.2359 ***	0.2639 ***
	(0.0264)	(0.0596)	(0.0619)
$Y_{i,t}$	-0.0294	-0.2009 **	0.4689 ***
	(0.0412)	(0.1031)	(0.0277)
$PR_{i,t}$		0.2469 **	0.2166
		(0.1193)	(0.7998)
$WH_{i,t}$		-0.0692	-0.2083
		(0.1410)	(0.1318)
$RS_{i,}$		0.4313 ***	0.4173 ***
		(0.1430)	(0.0031)
$X_{1,i,t}$	0.0048	-0.2241 ***	-0.2157
	(0.0049)	(0.0268)	(1.2530)
$X_{2,i,t}$	1.2660 ***	10.2551 ***	10.2820 ***
	(0.1207)	(1.2175)	(0.7786)
$X_{3,i,t}$	0.8533 ***	-0.6845	-0.5019 ***
	(0.1031)	(0.7547)	(0.1093)
$X_{4,i,t}$		-0.0119	-0.0503 *
		(0.1056)	(0.0268)
$X_{5,i,t}$		0.0240 ***	0.0222
		(0.0029)	(1.2652)
$X_{1,i,t}\ PR_{i,t}$		0.0944 ***	0.1050 **
		(0.0259)	(0.0445)
$X_{2,i,t}\ PR_{i,t}$		-9.0794 ***	-9.0834 ***
		(1.2294)	(1.3150)
$X_{3,i,t}\ PR_{i,t}$		1.0029	0.7582
		(0.7738)	(0.8718)
$X_{4,i,t}\ PR_{i,t}$		-0.1903	-0.1990
		(0.1281)	(0.2064)
$X_{5,i,t}\ PR_{i,t}$		-0.0118 ***	-0.0133 **
		(0.0030)	(0.0059)
$X_{1,i,t}\ WH_{i,t}$		-0.0008	0.0212
		(0.0428)	(0.0288)
$X_{2,i,t}\ WH_{i,t}$		-9.6539 ***	-9.6878 ***
		(1.2778)	(1.2688)
$X_{3,i,t}\ WH_{i,t}$		0.3592	0.1982
		(0.8460)	(0.7901)
$X_{4,i,t}\ WH_{i,t}$		0.2918	0.2544 **
		(0.2004)	(0.1240)
$X_{5,i,t}\ WH_{i,t}$		-0.0008	-0.0069 *
		(0.0054)	(0.0036)

$X_{1,i,t}$ $RS_{i,}$		0.0114		-0.0043	
		(0.0277)		(0.0751)	
$X_{2,i,t}$ $RS_{i,}$		-7.8674	***	-7.8905	***
		(1.2329)		(0.0737)	
$X_{3,i,t}$ $RS_{i,}$		2.2405	***	2.1380	***
		(0.7673)		(0.0705)	
$X_{4,i,t}$ $RS_{i,}$		0.1757		0.2359	***
		(0.1192)		(0.0692)	
$X_{5,i,t}$ $RS_{i,}$		-0.0058	*	-0.0036	
		(0.0034)		(0.0685)	
$\lambda_{i,t}$				-0.3303	***
				(0.1031)	
Adjusted R^2	0.0667	0.1608		0.1633	
F-Statistic	56.24	14.18		10.32	

Notes: Number of observations: 3051. Standard errors are in parentheses.
[*]Significant at , [**] significant at 0.05, [***] significant at 0.001.
[a]Year effects are included in the OLS model and are not reported. None of the year effects are significant at 0.10 or less.
[b]Year effects are included in the 2nd step of the self-selection model and are not reported. Fifteen out of the 19 year binary variables are significant at 0.10 or less.

Table 5. Probit Estimates for the First Stage of Model 3, the Self Selection Model

	Parameter Estimate		Standard Error	Marginal Effects
Intercept	-3.7634	***	0.5572	
$PR_{i,t}$	0.9250	*	0.5743	0.2545
$WH_{i,t}$	-1.0869		1.4776	-0.0011
$RS_{i,}$	-5.8197	***	2.0667	-0.0622
$X_{1,i,t}$	0.1932	***	0.0707	0.0138
$X_{2,i,t}$	-0.1550		5.4949	-0.0029
$X_{3,i,t}$	-5.2660		5.1314	-0.1746
$X_{4,i,t}$	0.3829		0.3706	0.0125
$X_{5,i,t}$	-0.0163		0.0401	-0.0005
$X_{1,i,t}\ PR_{i,t}$	-0.4665	***	0.1304	-0.0476
$X_{2,i,t}\ PR_{i,t}$	-0.0481		5.5555	-0.0081
$X_{3,i,t}\ PR_{i,t}$	6.0326		5.1801	0.4171
$X_{4,i,t}\ PR_{i,t}$	0.3844		0.4881	0.0268
$X_{5,i,t}\ PR_{i,t}$	0.0399	***	0.0088	0.0039
$X_{1,i,t}\ WH_{i,t}$	0.3945		0.4704	0.0215
$X_{2,i,t}\ WH_{i,t}$	-0.8090		6.2774	-0.1099
$X_{3,i,t}\ WH_{i,t}$	-3.4048		12.2215	-0.4258
$X_{4,i,t}\ WH_{i,t}$	0.6129		0.7147	0.0771
$X_{5,i,t}\ WH_{i,t}$	0.0121		0.0386	0.0005
$X_{1,i,t}\ RS_{i,}$	2.6834	***	0.7951	0.0205
$X_{2,i,t}\ RS_{i,}$	0.7287		5.7545	0.0055
$X_{3,i,t}\ RS_{i,}$	-2.5752		5.6400	-0.0214
$X_{4,i,t}\ RS_{i,}$	-1.0198	*	0.5381	-0.0084
$X_{5,i,t}\ RS_{i,}$	-0.2582	***	0.0756	-0.0020

Notes: Number of observations: 3051. *Significant at 0.10, ** significant at 0.05, *** significant at 0.001. Year effects are included in the 1st step of the self-selection model and are not reported. Fifteen out of the 19 year binary variables are significant at 0.10 or less.