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# Factors Explaining Growth of Small and Medium-Large Food-Manufacturing Businesses in the United States

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This study analyzes factors influencing growth of small and medium-large food-manufacturing establishments in the United States. The results provide evidence suggesting that small food manufacturing establishments tend to grow in areas with a relatively low per-capita income and in areas where the number of small establishments is large relative to the number of medium-large establishments. In contrast, the number of medium-large establishments tends to increase in areas with a relatively high per-capita income and in areas where the number of small establishments is small relative to the number of medium-large establishments.

Food-manufacturing industries are traditionally considered to be important determinants of the economic development of rural areas. Food industries establish their businesses in rural areas because these regions provide easy access to agricultural raw materials and low-cost labor. A number of previous studies analyzed community attributes influencing location and investment decisions of food manufacturing industries and factors influencing their growth. The analyzed factors are typically associated with agricultural input markets, labor markets, food-industry output markets, agglomeration, and fiscal policy. To the best of our knowledge there is no study that has examined differences in the patterns of growth of small versus medium-large food-manufacturing establishments. The results of this analysis would be important for developing policies targeting economic development of small-scale food-manufacturing businesses.

This paper examines factors influencing growth of small and medium-large food-manufacturing establishments in the United States. Section 2 presents a brief literature review and Section 3 presents a conceptual model. Section 4 discusses the data and hypotheses to be tested. Section 5 presents the estimation results and is followed by the conclusion.

## Literature Review

Food-manufacturing industries are classified into three categories: supply-oriented, demand-oriented and footloose industries (Connor and Schiek 1997).

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Supply-oriented industries are located in areas providing easy access to agricultural input markets, as a high share of these industries' costs is represented by agricultural input costs. Demand-oriented industries are located in urban and metropolitan areas, as they depend on easy access to output markets, and transportation and distribution costs are significant in this case. Footloose industries are involved in production of multiple products; neither distribution nor input costs are the prevailing determinant of their location decisions.

A group of previous studies analyzed community attributes influencing location decisions and growth of food-manufacturing industries. The geographic markets under analysis were as large as the national market (Goetz 1997) and as small as an individual state market (Holcomb et al. 1999; Holcomb, Flores-Bastidas, and Woods 2000). Goetz (1997) examined the state- and county-level determinants of food-manufacturing growth and focused on footloose firms. The study finds that the levels of transportation costs, wages and property taxes tend to have a negative effect on the growth of food-manufacturing industries.

Holcomb et al. (1999) and Holcomb, Flores-Bastidas, and Woods (2000) compared the plant-location determinants of food and non-food agricultural processors in Oklahoma. The results suggest that the availability of utilities, waste disposal, raw materials, and labor influenced the location decisions of these firms. In addition, tax and crime rates were some of the major factors considered by both agricultural and non-agricultural food processors.

Singer and Bartels (1996) found that demand-oriented food-manufacturing industries had lesser growth than did footloose and supply-oriented industries in the U.S. Midwest. High transportation

costs tend to hinder demand-oriented firms from competing outside of the local or regional markets. Footloose and supply-oriented industries, on the other hand, are able to take advantage of increased demand in distant markets. The study finds that the wage level is negatively related to the growth of food-manufacturing industries, while the level of population has a positive relationship.

### Conceptual Model

Following previous studies (Goetz 1997; Henderson and McNamara 1997, 2000), we hypothesize that growth of food-manufacturing industries depends on good access to agricultural input markets, labor markets, and output markets and on agglomeration. Therefore, the conceptual model used in this study is represented as:

- (1) *Growth = f(Ag Input Market, Food-Industry Output Market, Labor Market, Agglomeration).*

This model is used to study growth of food-manufacturing establishments using state-level data. We hypothesize that the growth pattern of food manufacturing businesses depends on their size. We expect to find differences in the patterns of growth of small and medium-large food-manufacturing establishments.

### Data and Hypotheses

According to the U.S. Economic Census, food-manufacturing industries are the industries that transform livestock and agricultural products into products for intermediate or final consumption. We analyze the three-digit-level industries, which means that we study all food-manufacturing industries as a group. Our variable of interest is a change (increase or decrease) in the number of food-manufacturing establishments. It is calculated as the difference in the total number of food-manufacturing establishments in each state between 1997 and 2002, and this is the dependent variable in our econometric models. This measure takes into account the effect of new establishments, establishments that exited the industry, and the establishments that were active these years.

We analyze growth characterizing three groups

of food-manufacturing establishments: small, medium-large and the overall group. Using the available data, we define a small establishment as one having less than 20 employees and we define a medium-large establishment as one having more than 20 employees. Small establishments are likely to be locally owned businesses, and in many cases these businesses are likely to be owned by agricultural producers. The U.S. Economic Census provides data on the total number of establishments and the number of establishments with 20 or more employees. Based on this information, we calculate the number of establishments with less than 20 employees (i.e. small food-manufacturing establishments).

Using the conceptual model and the data collected, we estimate an econometric model for each of the identified groups of food-manufacturing establishments. While the dependent variables differ across these models, the same independent variables are used in all three models. These independent variables represent the agricultural input market, the output market, the labor market, agglomeration, and economic effectiveness. Independent variables are collected for the years that precede the years for which the growth variable is calculated, based on the assumption that the current decisions of food-manufacturing businesses are based on past information. Table 1 summarizes the explanatory variables, expected signs and the data sources used to collect this information. Below we provide a brief discussion of these variables and the corresponding hypotheses.

#### *Agricultural Input Market*

The value of agricultural products is used to measure the availability of agricultural raw materials for food-manufacturing businesses located in each state. This variable is expected to be positively related to the growth of the number of food-manufacturing establishments and independent on their size.

#### *Food-Manufacturing Output Market*

Two variables are used to represent the food-manufacturing output market: per-capita income and population. Both per-capita income and population are hypothesized to be positively related to the growth of the number of food-manufacturing establish-

**Table 1. Explanatory Variables, Expected Signs, and Data Sources.**

Variable (expected sign)	Definition	Source
<i>Agricultural input market</i>		
Ag product value (+)	Market value of agricultural products (1997)	USDA-NASS
<i>Food-manufacturing industry output market</i>		
Population (+)	Population (2000)	U.S. Census Bureau
Income (+)	Per-capita income (1999)	U.S. Census Bureau
<i>Labor market</i>		
Education (+)	Number of people with at least high school degree (2000)	U.S. Census Bureau
Wage (-)	Ratio of production workers wages to the number of production workers hours (1997)	Calculated using data reported by the U.S. Economic Census
<i>Agglomeration</i>		
Concentration (-)	Number of food-manufacturing establishments (1997)	U.S. Economic Census
Small/medium-large ratio (+)	Ratio of the number of small establishments to the number of medium-large establishments (1997)	Calculated using data reported by the U.S. Economic Census
<i>Economic effectiveness</i>		
Production workers (+)	Ratio of production workers to the total number of employees, % (1997)	Calculated using data reported by the U.S. Economic Census
Value added/value of shipments (+)	Ratio of value added to value of shipments, % (1997)	Calculated using data reported by the U.S. Economic Census
<i>Other variables</i>		
Poverty rate (-)	Poverty rate (2000)	U.S. Census Bureau

The data are collected at the state level.

ments, as these variables determine the size of the output market. The effects of these variables might be stronger in the case of small establishments, as small food-manufacturing businesses are more likely to depend on access to output markets than are medium-large food-manufacturing businesses that have well-developed distribution systems for their products.

#### *Labor Market*

Two variables are used to examine the effect of labor market on the growth of the number of food-manufacturing establishments: labor quality and cost of labor. The quality of labor is measured by education level; it is represented by the number of people with at least a high-school degree. The

quality of education is expected to have a positive effect on the growth of the number of food-manufacturing establishments. In contrast, the cost of labor is expected to have a negative effect on the growth. Cost of labor is measured as the ratio of the annual production-workers' wages to the total number of production-workers' hours. This is the cost of using one production worker hour in food manufacturing.

#### *Agglomeration*

Two variables are used to measure the effect of agglomeration on the growth of the number of food-manufacturing establishments. First, following previous studies, we use the number of food-manufacturing establishments existing in a state in the previous period as a proxy for the agglomeration effect. This variable measures the concentration of food-manufacturing establishments in each state and is hypothesized to have a negative effect on the growth of the number of food-manufacturing establishments. The more establishments that are located in an area in the current period, the less likely the total number of establishments is to increase in the future. Secondly, we develop a new variable that is calculated as a ratio of the number of small establishments to the number of medium-large establishments. This variable captures the effect of competition between small and medium-large food-manufacturing businesses in a region. An increase in this ratio is expected to have a positive effect on the growth of the number of food-manufacturing establishments.

#### *Economic Effectiveness*

An important factor influencing growth of food-manufacturing establishments is the effectiveness of their economic performance. More-effective businesses are hypothesized to grow faster than are less-effective businesses. To capture the effect of economic effectiveness, we develop two variables. The first variable is a ratio of value added to the value of shipments and the second variable is a ratio of production workers to the total number of employees. The former characterizes the overall effectiveness of production and marketing activities and the latter characterizes the effectiveness of the use of production workers. Both variables are ex-

pected to be positively related to the growth of the number of food-manufacturing establishments.

#### *Other Variables*

The poverty rate is a factor that is likely to influence the growth of the number of food-manufacturing businesses. To control for this effect, we include a poverty rate corresponding to each state. The poverty rate is expected to have a negative effect on the growth of food-manufacturing establishments. Food-manufacturing businesses are less likely to grow in areas with a high poverty rate, as they would not have a good access to resources and output markets.

#### **Results**

Table 2 presents the OLS estimation results of the growth models for all food-manufacturing establishments and for small and medium-large food-manufacturing establishments. In the case of all food-manufacturing establishments, market value of agricultural products, population, labor quality, and poverty rate had statistically significant effects on the growth of the number of establishments between 1997 and 2002. An increase in the market value of agricultural products grown in a state or an increase in population has a positive effect on the growth, as hypothesized. An increase in the labor quality or an increase in the poverty rate has a negative effect on the growth of all food-manufacturing establishments. The estimated labor-quality effect contradicts our expectations.

In the case of medium-large food-manufacturing establishments, the market value of agricultural products, population, labor quality, and concentration of food businesses have statistically significant effects on growth. An increase in the market value of agricultural products grown in a state, an increase in population, or an increase in the number of food-manufacturing establishments has a positive effect on the growth of this group of establishments. All effects are as expected except that of concentration. The labor quality has a negative effect on the growth of medium-large food-manufacturing establishments, which contradicts our predictions.

In the case of small food-manufacturing establishments, the market value of agricultural products, population, per-capita income, labor quality,

**Table 2. The OLS Estimation Results: Growth of the Number of Food-Manufacturing Establishments in the U.S. (Estimated Coefficients).**

Explanatory variable	Number of food-manufacturing establishments		
	All	Medium-large	Small
<i>Agricultural Market</i>			
Ag product value	2.97E-06*	6.21E-07*	2.35E-06*
<i>Food-manufacturing industry output market</i>			
Population	5.56E-05*	7.90E-06*	4.77E-05*
Per-capita income	-3.10E-03	7.21E-04	-3.82E-03*
<i>Labor Market</i>			
Education	-9.73E-05*	-2.04E-05*	-7.70E-05*
Wage	4.66E-02	-5.24E-01	5.71E-01
<i>Agglomeration</i>			
Concentration	-2.90E-02	2.79E-02*	-5.69E-02*
Small/medium-large ratio	9.41	-4.19E-01	9.83
<i>Economic Effectiveness</i>			
Production workers	-5.20E+01	-4.17	-4.78E+01
Value added/value of shipments	78.13	14.48	63.65
<i>Other variables</i>			
Poverty rate	-5.52*	-0.20	-5.33*
R <sup>2</sup>	0.67	0.40	0.66

\* indicates statistical significance using either a two-sided or a one-sided Z-test at the 10%-significance level.

concentration, and poverty rate have statistically significant effects on growth. An increase in the market value of agricultural products or an increase in population results in an increase in the number of small food-manufacturing establishments. An increase in labor quality, concentration of the establishments, or poverty rate has a negative effect on the growth of the number of small establishments. Contrary to our expectations, labor quality is negatively related to the growth of the number of small food-manufacturing establishments.

If the results are compared across the three models, several similarities and differences in the patterns explaining growth of the analyzed groups

of food-manufacturing establishments are evident. The effect of market value of agricultural products is consistent across the three models. The number of food-manufacturing establishments increases in areas with rich agricultural production. An interesting observation is that in terms of the magnitude of the estimated coefficient for this variable, the effect is stronger for small establishments than for medium-large establishments. The effect of population is consistent across all three models as well. The number of people in a state determines the output-market size and this variable is positively related to the growth of food-manufacturing establishments regardless of their size.

The effect of per-capita income is different for small and medium-large establishments. This variable has a positive effect on the growth of medium-large food-manufacturing establishments and has a negative effect on the growth of small food-manufacturing establishments. The effect of labor quality is consistent across three models. Labor quality is negatively related to the growth of food-manufacturing establishments, an outcome that contradicts our expectations. One possible explanation for this is that a large share of employees in food-manufacturing businesses is represented by production workers, so the labor-quality factor may not be significant in this case.

The effect of labor cost depends on the size of food-manufacturing establishments. The cost of labor is negatively related to the growth of medium-large food-manufacturing establishments and positively related to the growth of small food-manufacturing establishments. One possible explanation for this pattern is that in the case of small businesses the owners are also likely to be employees, which would result in higher wages associated with the growth of this group of establishments. In contrast, the number of medium-large food-manufacturing establishments increases if the labor cost is relatively low.

The number of food-manufacturing establishments in the previous period (i.e., agglomeration) has a positive effect on the growth of medium-large establishments and a negative effect on the growth of small establishments. One possible explanation for this difference is that large companies typically comprise from several establishments, and when new establishments of the same company are built they are located in the areas with the existing operations. In the case of small businesses, it is likely that a single firm is represented by one establishment. Therefore, if there are many small establishments in the area, the number of small food-manufacturing establishments is not increasing.

The ratio of the number of small establishments to the number of medium-large establishments is negatively related to the growth of medium-large establishments and positively related to the growth of small establishments. When this ratio is high (i.e., the number of small establishments is large relative to the number of medium-large establishments), the number of small food-manufacturing establishments tends to increase (i.e., a positive ef-

fect of regional competition). However, the number of medium-large establishments tends to decrease under the same conditions.

The level of overall effectiveness of economic performance tends to be positively related to the growth of food-manufacturing establishments; this effect is consistent across all three models. This means that if a share of value added in the total value of shipments increases, the growth of the number of establishments, regardless of their size, increases as well. The ratio of the effectiveness of the use of production workers is negatively related to the growth of food-manufacturing establishments in all three models; the sign of this effect is not as expected. Finally, poverty rate is negatively related to the growth of all three groups of establishments. Food-manufacturing establishments tend to grow in regions with a lower level of poverty, as they have better access to the resources and output markets in these areas.

## Conclusion

This study provides empirical evidence suggesting that the patterns of growth of small and medium-large food-manufacturing establishments in the United States are different. We find that market value of agricultural products grown in the area and population have a positive effect on the growth of the number of food-manufacturing establishments regardless of their size. In addition, the level of the effectiveness of economic performance tends to be positively related to the growth of both medium-large and small food-manufacturing establishments.

Per-capita income, cost of labor, concentration, and regional competition between small and medium-large establishments tend to have opposite effects in the two analyzed groups of food-manufacturing establishments. Per-capita income and the number of food-manufacturing establishments in the previous period are positively related to the growth of the number of medium-large food-manufacturing establishments, but these variables are negatively related to the growth of small food-manufacturing establishments. Furthermore, the cost of labor and the intensity of regional competition between small and medium-large establishments are negatively related to the growth of medium-large establishments but positively related to the growth of small establishments.

These results may suggest that small food-manufacturing businesses tend to grow in areas with a relatively low per-capita income and in the areas where the number of small establishments is relatively large compared to the number of medium-large establishments. In contrast, the number of medium-large establishments tends to increase in areas with a relatively high per-capita income and in areas where the number of small establishments is small relative to the number of medium-large establishments.

## References

- Connor, J. M. and W. Schiek. 1997. *Food Processing: An Industrial Powerhouse in Transition*, 2<sup>nd</sup> rev. ed. John Wiley and Sons: New York.
- Goetz, S. 1997. "State and County-Level Determinants of Food Manufacturing Establishment Growth: 1987-93." *American Journal of Agricultural Economics* 79: 838-850.
- Henderson, J. and K.T McNamara. 1997. "Community Attributes Influencing Local Food Processing Growth in the U.S. Corn Belt." *Canadian Journal of Agricultural Economics* 45: 235-250.
- Henderson J. and K.T McNamara. 2000. "The Location of Food Manufacturing Plant Investments in Corn Belt Counties." *Journal of Agricultural and Resource Economics* 25: 680-697.
- Holcomb R.B., Flores-Bastidas, and M.D. Woods. 2000. "A Comparison of Plant Location Determinants: Food vs. Non-Food Agricultural Processors." Oklahoma Cooperative Extension Service Fact Sheet FAPC-112.
- Holcomb, R.B., G. Muske, C. Lyford, and M. Woods. 1999. "How Can Oklahoma Communities Attract Food Manufacturing Companies?" Oklahoma Cooperative Extension Service Fact Sheet WF-914.
- Singer, M. and C. Bartels. 1996. "The Food Manufacturing Industry in the Midwest." Federal Reserve Bank of Chicago. March.
- U.S. Census Bureau. various years. <http://www.census.gov/>.
- USDA-NASS. 1997 and 2002. *U.S. Census of Agriculture*. <http://www.nass.usda.gov/>
- U.S. Economic Census. 1997 and 2002. <http://www.census.gov/>.