# VERTICAL INTEGRATION IN AGRICULTURAL AND FOOD MARKETING

Richard L. Kilmer*



## INTRODUCTION

Vertical integration (VI) is defined as the ownership of the production of a previously purchased input used in the manufacture of an output or the ownership of a production unit that previously had purchased the output from a particular firm. The act of ownership internalizes the exchange process. Use of the external market to obtain an input or to exchange an output may have been through the use of a contract or a spot market. The failure of the external market creates profit and risk incentives for the firm to vertically integrate.

The traditional vertical market channel in the agricultural and food marketing system starts with the farm and goes to the manufacturer (first handler) who may be a processor, packing house/elevator, broker, or manufacturer and then goes to a wholesaler and a retailer. The manufacturing level collects the product and transforms it in form, space and/or time. Some of the product may be sold to producers for manufacture into other goods. The remaining manufactured product will go to the consumer and be consumed in an untransformed state (e.g. tomatoes, oranges) or transformed state (e.g. tomato sauce, concentrated orange juice).

The objective of this article is to project the extent of backward and forward VI at the manufacturer level and the extent of backward integration at the retail level. The first section of the article provides a perspective on the extent of VI at each level.

---

*Richard L. Kilmer is associate professor, Food and Resource Economics Department, University of Florida. Florida Agricultural Experiment Station Journal Series No. ____.

presented @ AAEA 1986

The second section summarizes the theoretical models of VI and identifies the variables and the impact of the variables on the extent of VI. The final section uses the variables identified in section 2 to project the change expected in VI over the next decade.

## THE EXTENT OF VERTICAL INTEGRATION

### Manufacturer Vertical Integration

#### Agricultural Production (Backward Integration)

VI between the manufacturer (first handler) and the agricultural producer increased between 1960 and 1980 (Table 1). There is more VI in crops than livestock. The increase in livestock has come from the poultry industry as the VI in eggs increased from 10 to 44 percent from 1960 to 1980 and an increase in turkeys from 4 to 28 percent. A slightly smaller increase has occurred in broilers (Marion, p. 15). A decrease is seen from 1970 to 1980 in fed cattle, sheep and lambs, fluid grade milk and manufacturing grade milk (Marion, p. 15). In 1983, eggs, broilers and turkeys represented 14.4 percent of farm cash receipts for livestock whereas fed cattle, sheep and lambs, fluid grade milk, and manufacturing grade milk represented 69.2 percent (Agricultural Statistics, p. 413). Thus, in order for an overall increase in VI to occur in livestock, VI in the poultry industry had to be and was significant.

In crops, significant increases in VI from 1960 to 1980 are found in vegetables for fresh market, vegetables for processing, potatoes, citrus fruits, other fruits and tree nuts, and seed crops. A significant decrease is found in sugarcane (Marion, p. 15). Vegetables represented 11.8 percent of crop cash receipts to farmers in 1983, whereas fruits and tree nuts of which citrus fruits and other fruits and tree nuts is a component represented 8.9 percent in 1983 (Agricultural Statistics, p. 413).

Table 1. Vertical Integration in the Agricultural and Food Marketing System.

| | | | |
|---|---|---|---|
| A. Manufacturing | | | |
| a. Backward Integration Into: | | | |
| 1. Agriculture by Commodity[a] | 1960 | 1970 | 1980 |
| Crops | 6.3 | 7.0 | 7.2 |
| Livestock | 3.6 | 4.5 | 4.8 |
| Total Farm output | 4.8 | 5.5 | 6.0 |
| | 1967 | 1972 | 1977 |
| 2. Agriculture[b] | 0.7[c] | 0.2[c] | 0.5[c] |
| 3. Manufacturing[b] | 3.2[c] | 3.0[c] | 2.9[c] |
| b. Forward Integration into: | | | |
| 1. Manufacturing | - | - | 4.0[d] |
| 2. Wholesaling | - | - | 14.7[d] |
| 3. Retailing | - | - | 4.0[d] |
| 4. Transportation &/or wholesaling &/or retailing | 24.0[c] | 21.6[c] | 20.1[c] |
| B. Retailer | | | |
| a. Backward Integration into: | | | |
| 1. Manufacturing[e] | 6.9 | 7.3 | 7.6 |
| 2. Wholesaling[f] | 46.3 | - | 46.9 |

Sources: a. Marion, p. 15.; b. Connor, et al, p. 178; c. Connor, et al, p. 212;

d. Connor , et al., p. 175; e. Marion, p. 336; f. Manchester, p. 5.

When the importance of backward integration by manufacturers into agriculture is viewed from the perspective of the manufacturers, backward integration is relatively unimportant. The proportion of the payroll of the 500 largest food and tobaccomanufacturers that are involved in agriculture decreased two tenths of one percent from 1967 to 1977 to a level of .5 percent (Table 1).

**Manufacture (Backward Integration)**

Food and tobacco manufacturers backward integrate into nonfood inputs. The 500 largest food and tobacco manufacturers are integrated into paperbags, paper-board boxes, sanitary food containers, commercial lithographic printing, plastics, resins, organic chemicals, plastic wrapping materials, glass jars, metal cans, and food machinery (Conner, p. 180). This integration has decreased from 3.2 percent of total payroll in 1967 to 2.9 percent in 1977.

**Manufacture, Wholesale, Retail (Forward Integration)**

Food and tobacco manufacturers forward integrate into manufacturing, wholesaling, and retailing. In 1977, food manufacturers shipped four percent of their total shipments to manufacturers owned by the same company (Table 1). In the same year, 14.7 percent of the shipments from food manufacturers were to warehouses or sales branches (wholesaling) owned by the company (Table 1). For breakfast cereals, flour, flour mixes, cookies and crackers, flavorings and coffee, the shipments were 40 percent (Conner, et al, p. 175). Finally, food manufacturers sent four percent of their shipments to company owned retailers. Forward VI totals 22.7 percent. This approximates the proportion of total payroll of the 500 largest food and tobacco manufacturers found in transportation, wholesaling and retailing (Table 1). VI has decreased since 1967.

## Retailer Vertical Integration

### Manufacture, Wholesaling (Backward Integration)

Backward VI by the nations 40 largest retailers increased slightly between 1967 and 1977 (Table 1). Most activity in manufacturing by retailers (2/3) is in fluid milk, fresh and processed meats and bread products (Marion, p. 336). The percentage of the eight largest firms' food store sales that was manufactured by their own company was 10.1 percent in 1977. For the ninth through the fortieth largest, the percentage was only 5 percent (Marion, p. 337).

Backward VI by retailers into the wholesaling function is significant. Retailers representing 46.9 percent of the nations retail food sales in 1977 owned distribution centers. It is likely that these retailers purchased a limited amount from wholesalers they did not own.

## VERTICAL INTEGRATION THEORY

There are many theories of vertical integration which are differentiated by assumptions. For example, successive monopoly in a vertical market system provides a profit incentive for the upstream(downstream) firm to VI. Quantity is restricted at two levels in the vertical system which reduces the profit earned by each monopolist. No profit incentive exists, however, if one of the firms behaves in a competitive manner. This is true unless the elasticity of input substitution is not zero in the downstream firm. The downstream firm is able to substitute away from the upstream firm's output which reduces the upstream monopolist's profit and creates a profit incentive to VI. Theories dealing with the various assumptions are surveyed by Kaserman, Warren-Boulton, Blair and Kaserman, and Casson. The markets and hierarchy theory that is attributed to Coase and Williamson (1975) is used by Casson in order to organize the many theories of VI. Casson uses the theories to identify twelve industrial

characteristics (pp. 37-38) that are hypothesized to effect VI. The variables can be used to empirically verify the theories of VI.

Casson groups the theories into the following general categories: (a) theories that deal with one economic agent having undisputed price making power in an external market, (b) theories that assume that the exchange in the external market takes place through bargaining, (c) theories that deal with the dynamic aspects of VI which includes the role of VI in discouraging competitive entry and the changes in the extent of VI over the life cycle of the industry, and (d) theories that deal with the costs of VI (e.g. financing costs and costs associated with setting up the internal coordination of previously independent units). A brief discussion of each of these areas follows along with the variables that can be used to empirically test the theories of VI. The variables identified by Casson (pp. 37-38) are used in this article as a basis for projecting the future of VI in agricultural and food marketing (Figure 1).

## Single Price Market

Theories that deal with single price markets may result in a price that differs from the price attainable under VI. These prices may be competitive, monopoly or a price in-between. In all cases, a profit incentive exists which encourages VI. "Wrong" prices can result from (a) a disequilibrium price resulting from governmental regulation, imperfect information, and a quota, (b) a price distortion through a sales tax which can be avoided through VI, (c) a monopolist who sells to an industry whose production function exhibits variable proportions which allows the buyers to substitute away from the monopolized input and reduces the monopolist's profit, (d) high fixed costs coupled with a high elasticity of demand (supply) may result in the buyer (seller) not being able to cover fixed costs which may result in no trade, (e) perfectly inelastic supply and demand which causes an indeterminate price and results in self interest bargaining, and (f) imperfect information which results in uncertain supply and/or demand in current

| Factors Influencing VI[a] | $X_1^{bc}$ | $X_2$ | $X_3$ | $X_4^d$ | $X_5^e$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ | $X_{10}$ | $X_{11}$ | $X_{12}^f$ | $X_{13}^f$ | $X_{14}^g$ | Change in VI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Impact on VI | >0 | >0 | >0 | >0 | >0 | >0 | >0 | >0 | <0 | <0 | <0 | <0 | <0 | >0 | $\gtrless 0$ |
| A. Manufacturing | | | | | | | | | | | | | | | |
| Backward VI into: | | | | | | | | | | | | | | | |
| 1. Agriculture | | | | | | | | | | | | | | | |
| Crops | | | | | | | | | | | | | | | |
| Livestock | ↑ | --> | --> | ↑ | ↑ | --> | --> | --> | --> | ↑ | --> | ↑ | ↑ | ↑ | ↑ |
| Total Farm Output | | | | | | | | | | | | | | | |
| Forward VI into: | | | | | | | | | | | | | | | |
| Manufacturing | | | | | | | | | | | | | | | |
| Wholesale | ↑ | --> | --> | ↑ | ↑ | --> | --> | --> | --> | ↑ | --> | ↑ | ↑ | ↑ | ↑ |
| Retail | | | | | | | | | | | | | | | |
| B. Retailer | | | | | | | | | | | | | | | |
| Backward VI into: | | | | | | | | | | | | | | | |
| Manufacturing | | | | | | | | | | | | | | | |
| Wholesale | ↑ | --> | --> | --> | --> | ↑ | --> | --> | --> | ↑ | ↑ | ↑ | ↑ | ↑ | ↓ |

a. Casson, pp. 37-38, except variables $X_{12}$ - $X_{14}$.
b. Found empirically significant by Levy, 1984, 1985; MacDonald; Tucker and Wilder.
c. Buyer and seller.
Found empirically significant by: d. MacDonald; e. Levy, 1985; f. Levy, 1984, 1985; g. Levy, 1985; Tucker and Wilder.

Figure 1. Factors Influencing and Direction of Change in the Vertical Integration of the Agricultural and Food Marketing System.

and future time periods, and uncertain quality. These factors are likely to provide a profit incentive for VI in lieu of external market exchange.

The industrial characteristics associated with single price market theories of VI include $X_1$ which is an index of monopoly power, $X_2$ which is an index of fiscal intervention in the product traded within the industry, $X_3$ which is the ratio of fixed to variable costs, $X_4$ which is a measure of the capital intensity of production, $X_5$ which is a measure of the importance of continuous flow economies, $X_6$ which is a measure of the importance of the quality control of inputs, and $X_7$ which is a measure of the perishability of inputs (Figure 1). An increase in any variable will cause VI to increase.

### Price Discovery Exchanges

The exchanges in this category entail bargaining situations. For example, bilateral monopoly is a situation in which the terms of trade are determined through negotiation. Williamson indicates that the cost of using the market mechanism is likely to be high if there is a small number of buyers and sellers which allows for the different parties to advance self interests and take advantage of others involved in the exchange process. The cost of market exchange is further increased as the terms of exchange become increasingly complex and based on imperfect information. The firm will likely vertical integrate if the cost savings from VI relative to market exchange is greater than the cost associated with internalizing an additional production unit. The industrial characteristic associated with bargaining situations is $X_1$ which is an index of monopoly power.

### The Dynamics of Vertical Integration

If an upstream monopolist is unable to control a new entrant into a downstream industry, the monopolist may choose to vertically integrate into the downstream industry in order to discourage entry and to enforce vertical control over the existing downstream firms.

The life cycle of an industry can effect the degree of VI exhibited at any point in time (Stigler). When an industry is in its infancy and a new input is required for a new output, a firm will likely manufacture the input itself. As the market for the new input expands and other input firms can exploit the economies of scale associated with an expanded market, the firms in the infant industry find it less costly to purchase the input instead of manufacturing the input. As the market for the output decreases and firms seek to cut costs and output prices, a new cost cutting technology may be employed to manufacture the input in lieu of purchasing the input.

The industrial characteristics associated with the dynamics of VI include $X_1$ (previously defined) and $X_8$ which measures the cost reduction potential of a new input technology (Figure 1). An increase in these variables will increase VI.

**Costs of Vertical Integration**

The final section on theories of VI contains factors that inhibit VI. The costs of VI include the acquisition costs of a new production unit, the financial and accounting consolidation, the managerial and organizational costs associated with the new production unit, and the positive or negative synergistic effect on the firm as it existed before integration. These costs are not well understood and require private firm information that is not readily available. Casson (p. 32) does identify two factors that are available. The degree of VI is effected by the scale discrepancy between plants at different levels of the vertical system. Firms that vertically integrate may need to horizontally integrate in order to possess enough capacity in one production unit to handle the capacity from a vertically adjacent production unit after VI. Diseconomies may be present in the horizontal integration to an extent which makes VI less attractive than external market exchange.

A second factor that negates the degree of VI among industries is the requirement that one or more stages of production can only operate efficiently by producing many

outputs and/or using many inputs. This may result from economies of scope or technical complementaries of production. The need to effectively manage the many inputs/outputs may exhaust the managerial expertise of the firm.

The industrial characteristics associated with the costs of VI include $X_9$ which is the ratio of the efficient scales of plants at adjacent stages (where the numerator is chosen as the larger of the two figures), $X_{10}$ which is the total number of joint inputs and joint outputs, $X_{11}$ which is an index of economies of scope in the utilization of indivisible assets, $X_{12}$ which is an index of overall firm size and $X_{13}$ which is an index of future demand growth. An increase in these variables will decrease VI. A final variable is $X_{14}$ which is a measure of the level of past VI in the industry (Figure 1). An increase in this variable will increase VI.

## FUTURE OF VERTICAL INTEGRATION IN FOOD AND AGRICULTURAL MARKETING

### Manufacturing Vertical Integration

**Agricultural Production (Backward Integration)**

Vertical integration will increase slightly in the crop portion of agriculture. The areas of greatest VI which are vegetables for fresh market (35 percent), vegetable for processing (15), potatoes (35), citrus fruits (35), other fruits and tree nuts (25) (Marion, p. 15) will continue to have small increases in VI. The perishability of vegetables; the concentration and capital intensity of processed potato manufacturers, and the discontent among farmers with respect to prices received (Marion, p. 169); the concentration at the manufacturer (processor) level, continuous flow economies and the variability in supply due to weather in citrus will cause the extent of vertical integration to increase in the crop category. The extent of vertical integration in corn, soybeans, and wheat will likely not change. These commodities appear to have exchange

mechanisms that work satisfactorily for both buyer and seller and futures markets that provide information on expected future prices. Also, spatial dispersion and the minimum efficient size farm is small enough to require a large number of farm units to supply adequately a grain elevator and/or manufacturing plant. Thus, the crops segment of farming will increase above its 7.2 percent level in 1980 (Marion, p. 15), but not dramatically.

The livestock segment of farming has the most potential for VI (Figure 1) at the farm level (4.8 percent, Marion, p. 15). Eggs (44 percent), broilers (10) and turkeys (28) (Marion, p. 15) are the most integrated and will continue to increase. The greatest potential for increasing VI in livestock is in the beef and pork industry. The increasing concentration in the slaughter plant and the feed lot industries; the large slaughter plants that represent large capital investments; the need for continuous flow of supply through the large slaughtering plants; and the decrease in the number of beef feedlots required to supply a 1,000,000 head per year packing plant provide economic forces that will increase the extent of vertical integration in beef and hog operations.

VI at the farm-manufacturing level (6 percent, Marion, p. 15) will increase over time. VI is a structural variable that changes slowly over time. Thus, the percentage of VI over the next ten years may reach 10 percent.

**Manufacturing, Wholesaling, Retailing (Forward Integration)**

Forward VI by food manufacturers will increase slightly by 1996, (Figure 1). The factors that favor VI include increasing concentration in food manufacturing, wholesaling, and retailing, the capital intensity of production, the need for a continuous flow of inputs, and the extent of past vertical integration. These factors will interact with factors that tend to discourage VI. They include the food industry practice of introducing new products, increasing firm size, and the continued growth in industry

demand. The increasing concentration on both sides of the market may cause bargaining to breakdown and encourage VI; however, the growth in products sold by manufacturers as well as the increase in firm size and total demand will use the management expertise and investment dollars that would be needed if VI were to occur. The net effect will be an increase in VI.

### Retailer Vertical Integration

Backward VI by retailers will decrease slightly (Figure 1). Factors that will discourage vertical integration include the increasing number of products included in retail stores, the minimum number of stores required to enter a new market, the increasing size of food retailing firms and the future growth of retail food sales. These factors will interact with the increasing concentration of food retailers, the importance of quality control among generic brands, and the existence of past VI by retailers. The management expertise required for undertaking VI will be fully employed with managing new superstores that have more products and also involved with managing the firm as it merges horizontally with other retailers. The net effect will be a slight decrease in VI.

## SUMMARY AND CONCLUSIONS

VI is a structural variable that changes slowly over time, although VI by an individual firm can change quickly and be larger or smaller than the industry average. The extent of vertical integration is directly influenced by the acceptability, or lack there of, of external exchange mechanisms such as the spot market or contracting. If external exchange performs in an acceptable manner, a firms managerial expertise and investment money can be used to expand horizontally and/or conglomerately. Vertical integration in the agricultural and food marketing system will increase over the next decade except the backward integration by retailers which will decrease slightly. Retailers will continue to expand horizontally if the regulation environment for horizontal mergers continues to be favorable. The factors that will have the most

influence on VI in the vertical system include increasing (a) concentration, (b) capital intensity, (c) flow economies, (d) number of inputs and outputs per firm, (e) economies of scope, (f) firm size, and (g) future demand.

In conclusion, VI is an alternate structure for organizing the vertical market system. The extent of VI depends on the firm's ability to efficiently absorb a vertical production unit such that the resulting firm is worth more after VI than both units were before VI. The net efficiency of VI depends on the potential cost savings of eliminating the external market compared to the cost of internalizing a production unit. The net cost of internalizing the production unit is dependent on the potential reduction in production costs and the costs associated with internally managing the new production unit. The internal management costs and its effect on the rest of the firm are sometimes assumed to be small or non-existent which may be incorrect. Most work on the theories of VI have dealt with the incentives for VI created by the external market failure. Work needs to be done on the costs of internally managing a previously independent production unit.

Finally, the wholesale sector is the most easily absorbed vertical market function. This is the only level of the vertical market system in which an equal amount of internal exchange (VI) and external exchange occurs. The other levels of the vertical market system are predominantly external exchange. The external market is and will continue to be an important component of the vertical system.

## BIBLIOGRAPHY

Blair, Roger D. and David L. Kaserman. Law and Economics of Vertical Integration and Control. New York: Academic Press, 1983.

Casson, Mark. "The Theory of Vertical Integration: A Survey and Synthesis." J. Econ. Studies. 11(1984):3-43.

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

Connor, John M., Richard T. Rogers, Bruce W. Marion, and Willard F. Mueller. The Food Manufacturing Industries: Structure, Strategies, Performance, and Policies. Lexington, Massachusetts: Lexington Books, 1985.

Kaserman, D.L. "Theories of Vertical Integration: Implications for Anti-Trust Policy." Antitrust Bull. 23(1978):483-510.

Levy, David T. "The Transaction Cost Approach to Vertical Integration: An Empirical Examination." Rev. Econ. Stat. 67(1985):438-45.

_____. "Testing Stigler's Interpretation of the Division of Labor Is Limited By the Extent of the Market." J. Industrial Econ. 32(1984):377-92.

MacDonald, James M. "Market Exchange OR Vertical Integration: An Empirical Analysis." Rev. Econ. Stat. 67(1985):327-31.

Manchester, Alden C. "The Farm and Food System: Major Characteristics and Trends." The Farm and Food System in Transition, Cooperative Extension Project Pamphlet FS1, Michigan State University, 1983.

Marion, Bruce W. The Organization and Performance of the U.S. Food System. Lexington, Massachusetts: Lexington Books, 1986.

Stigler, G.J. "The Division of Labor is Limited by the Extent of the Market." J. Polit. Econ. 59(1951):185-93.

Tucker, Irvin B. and Ronald P. Wilder. "Trends In Vertical Integration In the U.S. Manufacturing Sector." J. Industrial Econ. 26(1977):81-94.

U.S. Department of Agriculture. Agricultural Statistics 1984. Washington D.C., 1985.

Warren-Boulton, F.R. Vertical Control of Markets: Business and Labour Practices. Cambridge Massachusetts: Ballinger Publishing Company, 1978.

Williamson, O.E. Markets and Hierarchies: Analysis and Anti-trust Implications . New York: Free Press, 1975.