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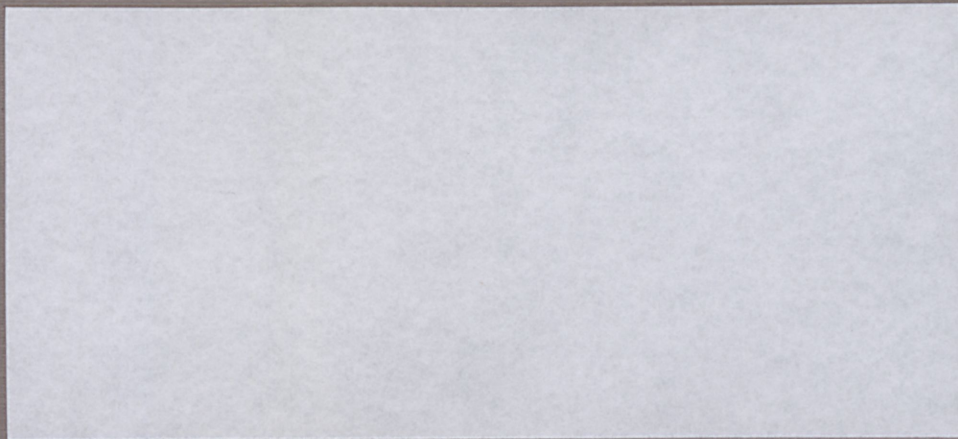
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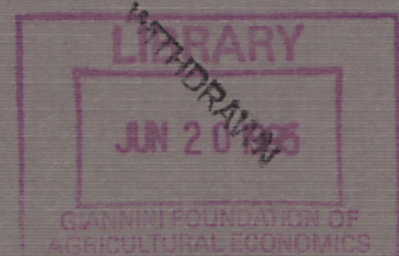
Food - Marketing



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**VERTICAL COORDINATION: CONCEPT,  
PRACTICE, THEORY AND POLICY IMPLICATIONS  
FOR THE AGRO-FOOD SECTOR**

**Dennis R. Henderson, Steve McCorrison,  
and Ian M. Sheldon**

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# VERTICAL COORDINATION: CONCEPT, PRACTICE, THEORY AND POLICY IMPLICATIONS FOR THE AGRO-FOOD SECTOR<sup>1</sup>

by

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## ABSTRACT

Vertical coordination in the agro-food sector is defined to include all transactional practices that tie price and output decisions among enterprises at the various stages from upstream basic producers, downstream to final consumers. These practices are typed by governance structure and ranked by the extent to which vertically interdependent entities behave independently or in concert. Vertical coordination within the sector appears to be trending toward structures with greater degrees of vertical control and proportionately less use of arm's length spot market transactions. Vertical control can be motivated by high transactions costs and intra-sector externalities such as double marginalization. Under a variety of imperfectly competitive market conditions, vertical ties can result in welfare-enhancing market impacts. Further, vertical ties can mitigate the diminishing effects of imperfect competition on agricultural policy reform. However, the choice between vertical contract or integration may depend upon the nature of strategic interaction between rival firms. In the light of this analysis, it may be appropriate to reexamine the rationale for competition policies that restrict vertical integration and the use of vertical contracts.

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## **VERTICAL COORDINATION: CONCEPT, PRACTICE, THEORY AND POLICY IMPLICATIONS FOR THE AGRO-FOOD SECTOR**

### **Purpose**

The objective of this paper is to examine the concept of vertical coordination, or vertical control, in the agro-food sector from three perspectives: (1) what the term is understood to mean, in both concept and practice, as it is observed both at national and international levels throughout the sector, (2) what knowledge of industrial organization and vertical coordination contributes to our understanding of market or economic performance in the sector as a whole, and (3) the implications of such an understanding for public policy; specifically, agricultural and competition policies.

In essence, three different perspectives are used to examine vertical coordination. These draw on the traditions of agricultural markets and hierarchies, industrial organization, and the economics of institutions and public policy. The intent is to link these approaches to a common theme in a way that contributes to a comprehensive concept of vertical markets.

### **1. Vertical Coordination in Concept and Practice**

The traditions of agricultural markets and hierarchies, e.g. how do transactions occur and what conditions the choice among transactional alternatives, provide the foundation for examining vertical coordination both as a concept and in actual practice.

#### **1.1 Vertical Interdependencies and Governance Structures**

The agro-food sector, at least in developed economies, can be conceptualized as a series of vertically interrelated stages, connected by output-input transactions, ranging from those industries supplying manufactured inputs to farms all the way through food

manufacturing to grocery retailing and food service. Mighell and Jones (1963) described vertical coordination within this system as "... all the ways in which these stages are directed and fitted together" (p. v). In this sense, vertical coordination encompasses a wide variety of activities, spanning the range from the sale of intermediate goods via arm's length transactions in spot markets, through a variety of informal and formal contractual arrangements, to consolidation of two or more vertically arrayed stages under the common management of a single firm, i.e. vertical integration. Following Williamson (1975, 1979), these coordinating practices are herein referred to as *governance structures*.

In addition to this view of vertical coordination as practice or behavior, there is some discussion in the literature as a performance norm, that is, in the sense of a vertical production-distribution chain being "perfectly coordinated." Marion (1976), for example, characterized perfect coordination as "...a perfect match between the goods coming out of an efficiently organized 'pipeline' and the preferences of customers" (p. 180). However, at least in part because of the difficulties in observing a state of coordination, the focus herein is on vertical coordination as a governance or control process, rather than as a performance norm. Nonetheless, under specific conditions unambiguous performance implications can be associated with certain vertical practices or behaviors. Such implications are discussed in part 2.

The simplest type of vertical system is one where, for example, an unprocessed agricultural commodity is sold from the farm-gate at price  $p_F$  to a food processing firm; this firm adds value to the commodity and sells a processed food product to a food retailer at price  $p_W$  which in turn sells it to consumers at price  $p_R$ . This is an example of vertical

coordination through spot market transactions. In a timeless world of perfectly functioning markets, spot transactions between the different stages would likely be the coordination practice that characterizes a vertical "food chain." However, a variety of more complex coordination practices characterize the sector, covering the range from spot market transactions through long-term contractual arrangements to vertical integration.

The agricultural marketing literature is replete with references to various forms of contracts and other types of arrangements used to coordinate outputs and inputs by nonintegrated firms. Examples include private treaties, market specification contracts, production management contracts, and resource-providing contracts (see Marion 1986, ch. 2, for example). Likewise, the industrial organization literature contains many analytical models of vertical integration (see Perry 1989, for example) and a wide array of inter-firm vertical restraints or contractual ties (see Katz 1989, for example). These differing practices are what Williamson (1979) has described as the "...governance structure of transactions" (p.234), where governance structures are defined as the "institutional matrix within which transactions are negotiated and executed" (p.239).

Typically, these arrangements have been viewed in the context of domestic markets. However, international governance structures are not difficult to document. Henderson and Handy (1993), for example, have shown that food manufacturers have a substantially higher propensity to enter foreign markets through direct investment (ownership integration) than through trade; Henderson and Sheldon (1992) have estimated that product licenses between firms in different countries account for a volume of international commerce in manufactured foods at least equal to that of transnational shipments. While direct investment and



licensing are often means of horizontal market expansion, both can also be used for vertical transactions.

## **1.2 A Hierarchy of Vertical Governance Structures**

When viewed as an array of mechanisms or behaviors by which the output of an up-stream entity is translated into an input for a down-stream entity, vertical coordination can be conceptualized in a hierarchical context. This is an extension of Williamson's (1975) market-hierarchy framework, where vertical integration, i.e. hierarchical organization within a firm, is treated as an alternative to both the spot market and various types of contractual coalitions. However, the hierarchy implied by vertical coordination as governance structures explicitly recognizes that contracts are not the same as spot markets. Hierarchy is also compatible with distinctions between types of contracts, thus accommodating Williamson's (1979) argument that different types of contracts, e.g., neoclassical, obligational, are in themselves unique governance structures.

Vertical coordination may be conceptualized within the framework of principal-agent (Ross, 1973). As shown by Katz (1989), vertical ties are a special case of principal-agent in that a given principal may have multiple agents and agents of multiple principals may play a competitive game amongst themselves. Drawing on this framework, the vertical coordination hierarchy can be viewed as a continuum, reflecting increasing degrees of consolidation of control by a principal in the vertical chain over up-stream and/or down-stream agents. Competitive rivalry may occur amongst agents, principals, or both, depending upon the extent to which principals have consolidated control over agents.

At the two extremes of the continuum, however, there is no principal-agent relationship. At one end are spot market transactions; at the other extreme is vertical integration.<sup>3</sup> Arrayed in between is an assortment of governance structures that specify terms of exchange. These can range from something as simple as a standard business procedure of delivering a truckload of market hogs to the same buying station every Monday morning, through private treaties, marketing agreements, and contracts that specify factor inputs, production practices, payment schedules, and/or performance incentives. In this sense, the hierarchical context relates to the extent to which the principal administers terms of exchange; none in the case of spot markets, completely so in the case of vertical integration.

Only a few attempts have been made to systematically arrange various types of contracts, licenses, franchises, ties, and other intermediate vertical linkages along a hierarchical scale. Gatignon and Anderson (1987), in a study of the determinants of the degree of control exercised by multinational corporations (MNCs) over vertically interdependent foreign subsidiaries, quantified governance structures on the basis of equity shares held by the MNC: wholly owned subsidiaries, dominant partnerships, balanced partnerships, and minority holdings. These structures were scaled from high control (wholly owned) to low control (minority partnerships), thus capturing both vertical integration and what Blois (1972) has labeled vertical quasi-integration, or control through partial ownership.

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<sup>3</sup>In spot markets, the market is relied on entirely; no firm acts as an agent for another. With vertical integration, agents have been subsumed by the principal. At all points in between, some agency relationship exists as the principal imposes a compensation scheme that induces another (the agent) to behave in a manner intended to maximize the principal's utility.

The attraction of the Gatignon and Anderson scaling is that it can be calculated from generally available firm-level data. Their translation from equity share to degree of control, however, was arbitrary. Further, no recognition of contracts was attempted. Thus, their approach can be viewed as a crude quantification of vertical control.

Analytically, Gatignon and Anderson found that wholly owned subsidiaries (vertical integration) could be discriminated from other vertical governance structures on the basis of variations in a number of descriptive variables used as proxies for transaction costs. However, the other categories of vertical linkages were econometrically indistinguishable.

Maddigan (1981) set out to develop a measure of vertical integration that is more computationally friendly than the Vertical Ratio<sup>4</sup> and overcomes the profits and primary industry biases of the value added to sales ratio<sup>5</sup>. She put forward a vertical industry connections index (VIC) that, in addition to specifying the industries within which a firm operates, incorporates vertical interdependencies drawn from input-output matrices. As such, it captures the full multitude of up-stream and down-stream product linkages for a firm, but is neutral to both conglomerate integration and a firm's position within the processing-distribution chain. Maddigan's formulation was limited, however, in that it included only industries in which a firm held a 100 percent equity position, thus ignoring both quasi-integration and the full hierarchical array of vertical contract possibilities.

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<sup>4</sup>Defined as the share of a firm's total product that is part of a vertical chain within the firm; see Rumelt (1974) for detail.

<sup>5</sup>This ratio is attributable to Adelman (1955). The profits bias comes from cyclical variation in profits that influence the ratio of value added to sales over time within the same firm, thus affecting time series measurements. The primary industry bias stems from high value added to sales ratios in primary stages of production compared to secondary stages where the cost of primary industry inputs is excluded from value added, thus affecting cross sectional comparisons.

Further, it is limited to application at the level of industry disaggregation for which input-output coefficients are available, and cannot discriminate between firms that operate in an identical set of industries.

Frank and Henderson (1992), in an analysis of vertical governance structures used by U.S. food manufacturers, developed a vertical coordination (VC) index by adding a vector of hierarchical control to Maddigan's VIC. This overcomes the limitation in the VIC index associated with its restriction to vertical integration. To express hierarchical control, agricultural commodity acquisitions by food manufacturing industries were partitioned into five discrete practices: spot markets, market specification contracts, production management contracts, resource providing contracts, and vertical integration. To represent the extent to which the principals (food manufacturers) directly influence the behavior of agents (farmers), a "percent of administrative control transferred" was assigned to each, ranging from zero for spot markets to 100 percent for vertical integration. While the assigned values of administrative control were arbitrary, alternative functional forms were tested. Findings revealed that the most robust results were associated with decreasing marginality, i.e. the amount of direct control by the principal over the agent increases at a decreasing rate.

While Frank and Henderson's VC is limited by the same level of industry disaggregation and firm-level discrimination problems as is Maddigan's VIC index, it represents a step towards a scaled measure that is consistent with the hierarchical concept. At the 4-digit U.S. SIC industry level, it has proven robust in econometric studies of both determinants (Frank and Henderson 1992) and performance implications (Henderson and

Frank 1990), thus supporting the view that the hierarchical concept of vertical coordination conveys useful empirical information.

### **1.3 Vertical Coordination in Practice**

At least in the U.S., most empirical documentation of vertical tie-in practices in the industrial organization literature focuses on vertical integration, whereas the agricultural economics literature has dealt more directly with the incidence of contracting, particularly between farms and down-stream entities. Where time-series data are available, somewhat divergent trends are observed for vertical integration and other indicators of vertical coordination, such as Maddigan's VIC index.

A number of studies have documented trends in vertical integration using various measures. Livesay and Porter (1969) examined more than 100 major U.S. manufacturing firms at six reference points between 1899 and 1948. Of the firms studied, 38 percent were integrated up-stream in 1899; this increased to 51 percent in 1909 and 55 percent by 1948. Down-stream integration rose from 11 percent in 1899 to 36 percent in 1929 and showed no trend thereafter.

Adelman (1955), using a ratio of value added to sales as a measure of vertical integration, examined the entire U.S. manufacturing sector from 1849 to 1930 and selected steel manufacturers from 1902 to 1952. He reported no clear trend toward either up-stream or down-stream integration. Laffer (1969) computed similar ratios for all firms in ten U.S. industrial sectors between 1929 and 1965, concluding that there was no discernible time trend. Based on essentially the same approach, Tucker and Wilder (1977) reportedly found

a small but statistically significant trend toward integration across 377 4-digit SIC U.S. manufacturing industries between 1954 and 1977.

Using the more robust VIC indicator, Maddigan measured changes in vertical integration in 96 randomly selected U.S. manufacturing firms between 1947 and 1972; the VIC index more than doubled in this 25 year period. Specific to the food sector, the composite value of VIC for the food manufacturing and distribution firms in Maddigan's sample increased by 42 percent.

There have been a number of estimates published regarding the extent of vertical contracting and integration. One of the more recent set of estimates is represented in Table 1. This shows an upward trend in other-than-spot-market methods of vertical coordination at the farm level, with the use of contracts significantly exceeding the incidence of vertical integration. Kirsch (1976) has described similar trends in Western Europe.

**TABLE 1. U.S. FARM PRODUCTION UNDER CONTRACT AND VERTICAL INTEGRATION (PERCENT OF TOTAL PRODUCTION)**

|             | Production and Marketing Contracts |      |      | Vertical Integration |      |      | Combined |      |      |
|-------------|------------------------------------|------|------|----------------------|------|------|----------|------|------|
|             | 1960                               | 1980 | 1990 | 1960                 | 1980 | 1990 | 1960     | 1980 | 1990 |
| Broilers    | 93.0                               | 90.0 | 92.0 | 5.4                  | 10.0 | 8.0  | 98.4     | 99.0 | 100  |
| Fed Cattle  | 10.0                               | 10.0 | 17.5 | 6.7                  | 6.7  | 5.0  | 16.7     | 14.5 | 22.5 |
| Hogs        | 0.7                                | 1.5  | 8.5  | 0.1                  | 0.1  | 6.0  | 0.8      | 1.6  | 14.5 |
| Feed Grains | 0.1                                | 7.0  | NA   | 0.4                  | 0.5  | NA   | 0.5      | 7.5  | NA   |
| Food Grains | 1.0                                | 8.0  | NA   | 0.3                  | 0.5  | NA   | 1.3      | 8.5  | NA   |
| Oil Seeds   | 1.0                                | 10.0 | NA   | 0.4                  | 0.5  | NA   | 1.4      | 10.5 | NA   |

Source: Barkema, Drabenstott, and Welch (1991).

Based on 1982 data, Frank and Henderson (1992) reported up-stream vertical coordination (VC) indices for 42 4-digit SIC food manufacturing industries in the U.S.

Index values ranged from zero for industries that procure virtually no input from U.S. farms, e.g. coffee roasters, to nearly one for industries with highly specialized farm commodity inputs and a high incidence of production management contracts, e.g. pickles, soups, canned specialties. The mean value across all 42 industries was 0.47, suggesting that, on average, vertical linkages between U.S. farms and food manufacturers fall roughly at the mid-point on a continuum from no principal-agent relationship, i.e. fully independent farms, to one where farmers behave exclusively as agents. With a standard deviation of 0.355, considerable variability exists across industries.

Little has been reported that quantifies vertical arrangements down-stream from food manufacturers. Anecdotal evidence, however, suggests that a wide array of such ties exist. For example, franchises between food service firms and restaurants are readily observable; private-label contracting and a variety of merchandising arrangements between food manufacturers and grocery retailers such as slotting fees and promotional allowances are frequently discussed in industry fora.

## **2. Industrial Organization and Vertical Coordination**

Industrial organization theory provides a framework for examining vertical coordination in terms of rational expectations regarding the implications of various vertical tie-in relationships for market prices, quantities sold, and economic welfare.

### **2.1 Why Vertical Coordination?**

Given evidence of a variety of vertical coordination practices in the food system, of interest here is understanding the motivation for firms to choose a particular practice or governance structure and how that choice impacts on economic welfare. There are two

dominant and related explanations for vertical coordination put forward in the literature. First, following Coase (1937) and Williamson, it is argued that the existence of transactions costs will result in a particular practice. Specifically, when transactions costs are high, markets may fail as efficient means of coordinating economic activity and hence, coordination is internalized through the adoption of some other governance structure. For example, as discussed by Klein, Crawford and Allen (1979), in the presence of appropriable specialized quasi-rents<sup>6</sup>, there may be a threat to one firm in a vertical marketing chain of another firm reneging on contracts. The choice of some other mechanism is a response to such opportunistic behavior if it is a means of reducing the costs of avoiding the appropriation of quasi-rents.

Second, and closely related, is the incentive for firms in a vertical market system to gain control through the use of arrangements that can be broadly thought of as *vertical restraints*. Although this aspect of vertical coordination has often been presented in terms of the monopolistic control of vertical markets, it can be viewed more generally as, "...firms' responses to problems of moral hazard, adverse selection and the need to share risk"<sup>7</sup> (Katz, 1989, p.660). Increasingly, industrial economists have attempted to formally model vertical market restraints (see, for example, Mathewson and Winter, 1986; Tirole, 1988; Perry, 1989; and Katz).

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<sup>6</sup> Following specific investment by a firm, quasi-rents may be generated, i.e. the excess value of an asset over its salvage value. The appropriable part of the quasi-rent is that excess of value over its value to the second highest-valuing user.

<sup>7</sup> Generally, *moral hazard* can be defined as "...actions of economic agents in maximizing their own utility to the detriment of others, in situations where they do not bear the full consequences of their actions due to uncertainty and incomplete or restricted contracts..." (Kotowitz, *New Palgrave*, 1987, p.549); and *adverse selection* can be defined as relating to situations where one party to a transaction is better informed than another about say quality, as a result, in equilibrium, the market will be dominated by goods of low quality.



Specific to the food sector, the analysis below focuses more on the latter explanation for vertical coordination than the former and thus on the question, why vertical control?

## 2.2 Vertical Restraints and the Food Chain

Tirole (1989) suggests that the motives for asserting vertical control are based on what he terms *externalities* between firms at adjacent stages in the chain. The essence of the idea can most readily be illustrated at the nexus between a food manufacturer and a retailer. However, the same type of analysis can be applied elsewhere in the agro-food sector.

Suppose a down-stream firm, e.g. a food retailer, does not take into account the incremental profit of an up-stream food processing firm when maximizing its own profits. As a result, the down-stream firm will tend to make decisions that do not maximize the aggregate profits of the vertical structure. Hence, the up-stream food manufacturer has an incentive to impose vertical restraints that remove the externality. Examples of such an externality include double marginalization or successive markups, input substitution by the down-stream firm, and moral hazard (see Tirole). In response to such externalities, firms may engage in a variety of vertical restraints (see Mathewson and Winter, and Katz).

Normally in economics the concern is with contracts that specify linear prices, i.e. a buyer pays a seller an amount proportional to the quantity purchased. However, vertical restraints can involve rather more complex contractual arrangements. In the case of the relationship between food manufacturers and retailers, common forms of vertical restraints are two-part tariffs, e.g. slotting allowances, and retail price maintenance. The former is the most straightforward example of a non-linear price, whereby the retailer is charged a two-part tariff by the manufacturer,  $R(q) = f + p_A q$ ,  $f$  being a fixed fee, i.e. a lump-sum

payment, and  $p_A q$  is the linear price. This form of contract can be made more general by allowing the fixed fee  $f$  to be either positive, as above, or negative, i.e. the retailer may receive a lump-sum payment from the manufacturer, e.g. a shelf or slot allowance.

In order to understand the role of vertical restraints, consider the case of a vertical marketing system where firm A sells a differentiated food product to firm B. Firm A is part of a monopolistically competitive food processing sector where there are barriers to entry, and firm B, a retailer, has local monopoly power. It is assumed that firm A produces under a technology of constant marginal costs  $c$ , and firm B's costs are also constant, being made up of the input price  $p_A$  and other costs  $k$ . Firm A's price is parametric, i.e. there is arm's length pricing, and firm B exercises no monopsony power.

The retailer's profit function can be written as:

$$(1) \quad \pi_B = p_B q - p_A q - kq$$

where  $q$  is firm B's output level, which for analytical convenience is also firm A's. Assuming the retailer chooses output to maximize profits, the first-order condition is:

$$(2) \quad p_B \left( 1 - \frac{1}{\eta_B} \right) - p_A - k - MR_B - p_A - k = 0$$

where  $\eta_B$  is the price elasticity of demand at retail, and  $MR_B$  is firm B's marginal revenue.

Given fixed proportions in the retailing production function, the derived demand for firm A's output is the net marginal revenue product:

$$(3) \quad p_A = MR_B - k$$

From (3), firm A's profits function can be written as:

$$(4) \quad \pi_A = MR_B q - (c + k)q$$

consequently, firm A's first-order condition can be derived as:

$$(5) \quad d(MR_B q)/dq - c + k$$

i.e. the food manufacturing firm is effectively maximizing profit by setting the schedule that is "marginal" to firm B's marginal revenue  $MR_B$  equal to the sum of marginal costs  $c+k$ .

Focussing on **Figure 1**, where final demand  $D_B$  is assumed linear,  $MR_B$  is firm B's marginal revenue curve and MD is the curve tracing out  $d(MR_B q)/dq$ . In equilibrium, the output of firm A is  $q_A$ , where MD cuts  $c+k$ . The processed food price is  $p_A$ , given by the fact that firm A's derived demand curve is  $k$  units below  $MR_B$  (see (3)). As a result, firm B's marginal cost is given as  $(p_A+k)$ , and therefore, firm B adds a retail margin to its perceived costs, charging the final output price  $p_B$ . Firm A's profits are given by the area  $abdp_A$  and those of the retailer are given by  $efp_B p_j$ .

Essentially, the food retailer, when maximizing its own profits, does not take into account the incremental profits of the up-stream food manufacturer. Consequently, the retailer makes a decision that does not maximize the profits of the vertical system, i.e. there is double marginalization.

Traditionally, vertical integration has been considered as a solution to this problem. For example, if firms A and B were integrated, the food product would be transferred at marginal cost of  $c$ , and the joint-profit maximizing output and price levels would be  $q_j$  and  $p_j$ , respectively. There would no longer be double marginalization, hence the externality would be internalized. In addition, vertical integration would be welfare-enhancing as it results in a net welfare gain of  $fghi$ .

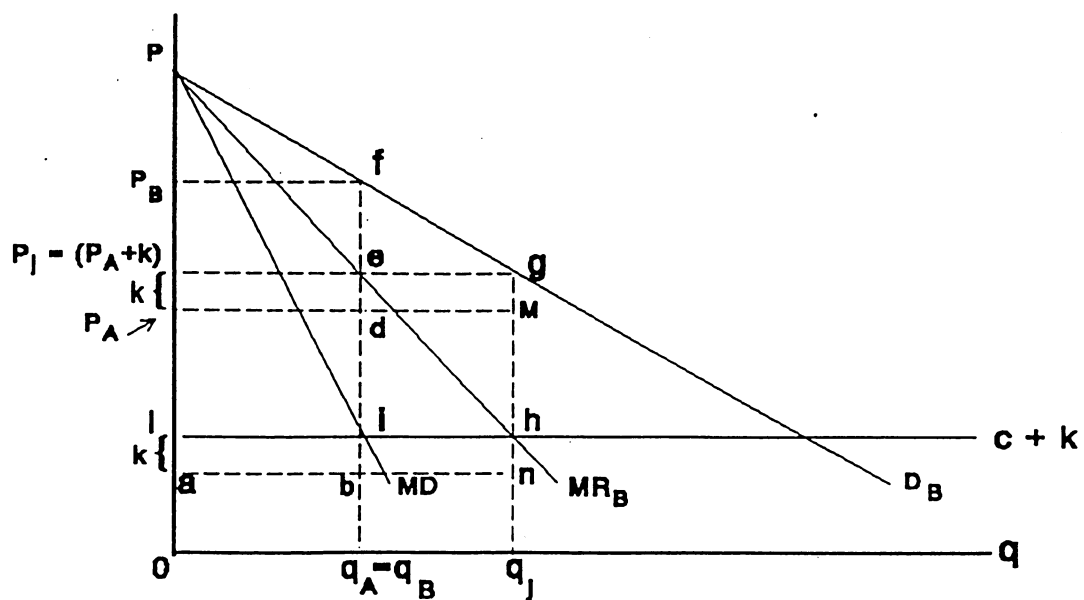


Figure 1: Food Manufacturer/Retailer Market Structure

The same result can be achieved through the use of a two-part tariff. The most obvious case is where firm A sets the price of the processed food product at  $p_A = c$ , and also charges a fixed fee of  $f$ . Assuming that the retailer is no worse off from accepting the contract, firm B will then choose the output level  $q_j$  at the margin, generating the price  $p_j$ . Clearly, joint profits are maximized at this point, and firm A appropriates a share of these from firm B by means of the fixed fee. Again there is a net welfare gain of  $fghi$ .

An equivalent result could be obtained with a negative fixed fee paid by the food manufacturer to the retailer. In the U.S. food system, attention has been increasingly drawn to financial incentives paid by food manufacturers to retailers in order to induce the latter to provide shelf space for and promote the sale of the manufacturers' products. Such retailing payments are variously referred to as slotting allowances, display allowances, placement allowances, billing allowances, promotional allowances, or merchandising

allowances<sup>8</sup>. These may be payments in cash or in kind, e.g. free goods. Regardless of the form, the salient characteristic is that they are lump-sum rather than per unit payments.

Suppose that firm B chooses to set output at the point where price  $p_j$  is equal to its marginal cost ( $p_A + k$ ), i.e. it acts as if it is a competitive firm facing a perfectly elastic demand curve, such that its first-order condition (2) becomes:

$$(6) \quad p_j - p_A - k = 0$$

The derived demand for firm A's output can be re-written as:

$$(7) \quad p_A = p_j - k$$

Substituting this into firm A's profit function, its first-order condition can now be derived as:

$$(8) \quad d(p_j, q)/dq = c + k$$

i.e. firm A is effectively maximizing profit now by setting the schedule that is marginal to firm B's demand curve equal to the sum of marginal costs  $c+k$ . In terms of **Figure 1**, the curve MD has swivelled around to  $MR_B$ , such that firm A sets the joint profit maximizing level of output  $q_j$ , charging the wholesale price of  $p_A$ , given that firm A's derived demand curve is now  $k$  units below  $D_B$ . Firm B simply charges a retail margin of  $k$  over the price  $p_A$ .

Clearly this generates the same net welfare gain as either vertical integration or a positive fixed fee. In this case, though, the negative fixed fee is received by firm B as the means by which it captures a share of joint profits from firm A. Logically, this allowance

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<sup>8</sup> Trade sources suggest that such allowances account for between a third and a half of total promotional expenditures by food manufacturers (Advertising Age, 1987).

will be strictly greater than the profits that firm B earned under double marginalization, but will leave firm A no worse off than it would be if it refused the contract.

The point is, vertical restraints may be sufficient to obtain the vertically integrated profit (Mathewson and Winter). In other words, it may not matter what form vertical control takes, because the outcome is the same from the firms' point of view. However, the question arises as to how sensitive the outcome of either vertical integration or vertical restraint is to the underlying assumptions concerning market structure, technology, and strategic interaction at different stages of the vertical chain.

First, although the chosen vertical market structure is highly specific, the result also holds for a succession of monopolists, as the number of markups simply increases. In addition, it has been shown that the result holds for other market structures such as an upstream monopoly selling to down-stream oligopolists, as long as the nature of the oligopolistic game is known. For example, Greenhut and Ohta (1976) show that if firms at stage B play a noncooperative game in quantities, vertical integration by firm A with some of the firms at stage B will lower final price and increase output. Greenhut and Ohta (1979) have also shown that if stage A is a Cournot oligopoly, and a subgroup of firms from stages A and B integrate, prices will fall and output increases. It should also be obvious that if stage A is a monopoly and B is competitive, the incentive does not exist for firm A to either integrate or use vertical restraints in order to remove the effects of double marginalization, although other incentives might exist.

Second, the production technology at stage B is assumed to be one of fixed proportions. This particular assumption has generated a good deal of debate. However, as

argued by Waterson (1982) and Abiru (1988), the debate is as much about the relevant market structure as the relevant technology. Following Tirole, and Waterson, suppose firm A is a monopoly supplier of an input to firm B, and a second substitute input is supplied in any volume at a fixed price, assumed to be the marginal cost of production  $c'$ . Firm B produces a final output with a variable proportions technology.

Essentially, because firm A sets a price in excess of marginal cost,  $p_A > c$ , the relative input prices to firm B exceed the true relative prices, i.e.  $p_A/c' > c/c'$ . Consequently, firm B substitutes away from firm A's input to the other input<sup>9</sup>, so that an externality arises to firm A. Suppose now that firm A integrates vertically with firm B. It will supply itself with its own input at marginal cost, and purchase the other input at marginal cost  $c'$ . Hence, under cost minimization, there is substitution to firm A's input, and a given level of final output can be produced at lower cost. The integrated monopolist's final output will rise and price will fall.

As Tirole shows, the same result can be achieved through the use of vertical restraints by firm A. The welfare effects here are clear; inputs are allocated optimally once the price of firm A's input is cut to marginal cost, and the integrated monopolist gains additional profit from increasing output at the margin. In addition, consumers benefit from lower prices. However, this result can be sensitive to market structure. While output price is generally expected to fall, in cases where vertical integration results in increased concentration down-stream, output prices will rise, i.e. if the number of firms at stage A is less than at stage B (see Abiru).

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<sup>9</sup> This argument was originally developed in papers by Vernon and Graham, 1971, Schmalensee, 1973, and Warren-Boulton, 1974.

Third, it can be shown that the predicted effects of vertical restraints are quite sensitive to both the nature of the game being played by the down-stream firms and the nature of the contract struck between food manufacturers and retailers. Following Bonnano and Vickers (1988), and Shaffer (1991), consider a situation where the up-stream food manufacturing sector consists of a duopoly selling homogeneous products to a down-stream retailing duopoly<sup>10</sup> that is differentiated by factors such as location. The vertical market relationship consists of a two-stage game where at the first-stage, each food manufacturer sets a price  $p_A^i$ ,  $i=1,2$ , which then becomes the retailers' per unit costs. At the second-stage retailers compete in prices, the equilibrium being Bertrand-Nash.

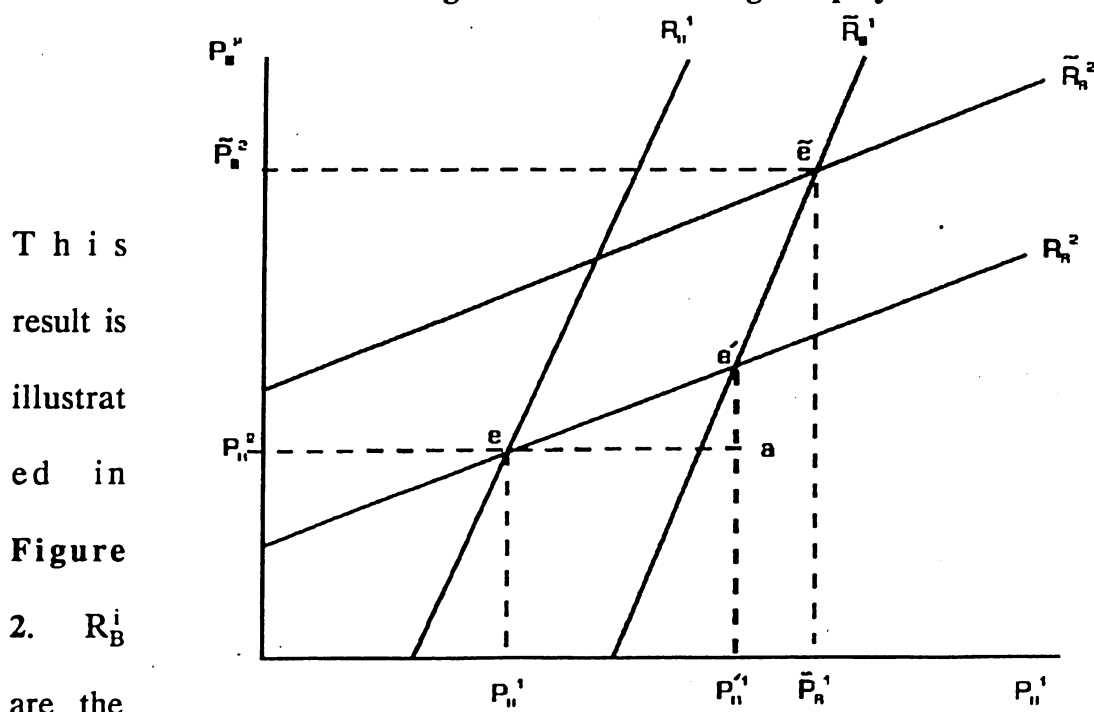
The nature and effects of vertical restraints will be a function of both the first and second-stage games. If, as in the case of Bonnano and Vickers, it is assumed that food manufacturer 1 deals only with retailer 1, and there is arm's length pricing, it will be optimal for the food manufacturer to charge a two-part tariff.

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<sup>10</sup> The model does generalize to an n-firm oligopoly, the assumption of duopoly being made simply for diagrammatic convenience.



Figure 2: Food Retailing Duopoly



This result is illustrated in Figure 2.  $R_B^1$  are the initial food retailer reaction functions, giving the Bertrand-Nash equilibrium at  $e$ . For analytical purposes, these are drawn for the case of processed food prices equal to marginal cost which coincides with the case where a manufacturer and retailer are vertically integrated. Suppose that manufacturer 1 raises its price beyond marginal cost. This shifts retailer 1's reaction function to  $\bar{R}_B^1$ , the new Bertrand-Nash equilibrium being at  $e'$ . This raises retailer 1's profits which are appropriated by food manufacturer 1 through a positive fixed fee. Given the nature of the stage-two game, it is also optimal for food manufacturer 2 to set a two-part tariff with a higher price, shifting retailer 2's reaction function to  $\bar{R}_B^2$ , the new equilibrium being at  $\bar{e}$ , the fixed fee being used to appropriate the increased profits of retailer 2. Therefore, in this case, vertical restraints are more profitable than vertical integration.

Alternatively, suppose, as in the case of Shaffer, that food retailers can select a food manufacturer before retail prices are set, i.e. there is now direct competition between manufacturers such that they must set a price that leads to a retailer earning at least as much in profit as implied by the other manufacturer's price. In the absence of fixed fees, neither manufacturer can credibly raise its price beyond marginal cost, and neither retailer can raise its price beyond the Bertrand-Nash level.

However, if observable<sup>11</sup> two-part tariff contracts are allowed, a food manufacturer can set a higher processed food price and pay a negative fixed fee to the retailer. The food retailer, facing a higher price, can credibly commit to paying this, because the lost revenue per sale is recovered through the fixed fee. But, in committing to pay the higher processed food price, competition is lessened at the retail level, as the other retailer raises price which feeds back into higher profits.

This result is described in Figure 2, where the direct and indirect effects of the contract are shown:  $e$  is again the initial equilibrium, and if manufacturer 1 raises price above marginal cost, the new equilibrium is at  $e'$ . Retailer 1 can credibly raise price if the manufacturer pays a fee that compensates for the direct effect of the loss of profits at point  $a$ . The indirect effect follows from the fact that as retailer 1's reaction function has been shifted, retailer 2 will also charge a higher price. Again, it will be optimal for both food manufacturers to offer this two-part tariff so that the new equilibrium is at  $\hat{e}$ , and vertical restraints are preferable to vertical integration.

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<sup>11</sup> If contracts were not observable, the game collapses to that without fixed fees.

The point about vertical restraints in this type of framework is that they facilitate collusion in the down-stream retail food market. In addition, the restraints reduce consumer welfare, unlike the earlier example. However, these results are also sensitive to the nature of strategic interaction between retailers. Suppose firms compete in quantities, such that their reaction functions are downward-sloping and the equilibrium is Cournot-Nash. In this case, it is no longer optimal for a food manufacturer to charge a price above marginal cost as it would shift profits to the other retailer. A two-part tariff would now comprise a lower processed food price and a fixed fee to the retailer.

In the case of a positive fixed fee, the food manufacturer appropriates the increased retailer profits, while in the case of a fee paid by the manufacturer, the manufacturer compensates the retailer for the lower profits due to the lower retail price. However, in the case of Cournot strategies, two-part tariffs are only in the individual interests of either manufacturers or retailers, not the collective interest, i.e. if both manufacturers use two-part tariffs with lower processed food prices, retailing profits will fall, so that both manufacturers and retailers lose. Given that, in the absence of cooperation the two-part game has the structure of a Prisoners' Dilemma, vertical integration would be the more profitable strategy for firms to follow.

In conclusion, this section demonstrates that industrial organization theory has a number of contributions to our understanding of vertical market relationships. First, the critical incentive for firms to gain vertical market control lies in the need for firms to remove externalities such as double marginalization. Second, in some cases vertical restraints such as two-part tariffs are sufficient to maximize vertical market profits, hence

are substitutes for vertical integration. Third, in modelling vertical markets, it is crucial to recognize that the effects of vertical integration and vertical restraints may be highly sensitive to technology and the nature of strategic interaction between firms. It is particularly important to recognize these factors when analyzing the effects of public policy, the focus of the final section.

### **3. Policy Issues**

Implications of vertical ties can be lifted out from the preceding analysis for both agricultural and competition policies. First, given that alternative forms of vertical coordination obtain in the agro-food sector, what implications arise for understanding the expected results of agricultural policy reform? Second, given the possibility of firms at one stage affecting strategic behavior and the market outcome at another stage of the vertical chain, what should be the appropriate role for competition policy and how does this accord with the actual practice of competition policy in various countries?

#### **3.1 Agricultural Policy**

Most analyses of agricultural reform proposals, whether unilateral or multilateral, ignore the food manufacturing and distribution sectors. Thus, the specification of most quantitative models used to measure the effects of policy reform imply that farmers produce food which is directly purchased by consumers<sup>12</sup>. In such an environment where farmers receive government support, consumers would typically gain from policy reform.

But, the existence of vertical market structures may affect this outcome. McCorrison and Sheldon (1993) conducted some preliminary analysis of this issue using a three-stage

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<sup>12</sup> See, for example, OECD (1987) and Tyers and Anderson (1992).

vertical market model incorporating a farm sector, a manufacturing sector, and a retail sector. It is an  $n$ -firm oligopolistic model, with any number of firms in the processing and retailing sectors, and although firms are assumed to set quantities in a Nash equilibrium, no specific form of strategic behavior (e.g. Cournot) is imposed. Given linear demand functions, food products are assumed to be differentiated at the retail level; there is arm's length pricing between the manufacturing sector and food retailing; and the retailing technology is one of fixed proportions. Thus, with imperfect competition at both the manufacturing and retailing stages of the marketing system, there exists double marginalization.

McCorrison and Sheldon's results demonstrate that, when agricultural policy reforms reduce price supports to farmers, which in turn reduces costs to manufacturers, and, subsequently, to retailers, consumer surplus will increase. But, this increase will be lower compared to the case where imperfect competition in the vertical chain is ignored. Thus, the existence of imperfect competition at any stage of the vertical chain will dissipate the benefits of agricultural policy reform to consumers. The theoretical results show that changes in economic welfare following policy reform will depend upon firm behavior (the more collusive is firm behavior, the smaller the increase in consumer surplus associated with a decrease in intervention prices), the number of firms in each vertical stage, and the degree of product differentiation of the final goods (the greater the degree of product differentiation, the smaller the increase in consumer surplus). Furthermore, the larger the number of vertical stages, the smaller the changes in welfare.

It is straightforward to see the impact that different forms of vertical coordination will have in this framework. Any coordination mechanism, ranging from vertical integration to any vertical contract, that removes the double marginalization externality may not only lead to a once-and-for-all increase in economic surplus, it may also lead to larger gains accruing to consumers following agricultural policy reform. Of course, as discussed in the part 2, such outcomes may be sensitive to initial conditions, particularly fixed versus variable proportions technology. Nonetheless, the general point is clear; oligopolistic vertical markets and alternative forms of vertical coordination may be important determinants of the welfare effects following agricultural policy reform.

### 3.2 Competition Policy

It is clear from the preceding analysis that there is no unambiguous normative role for public policy in the context of vertical markets. If one takes economic welfare to be the relevant criterion, it is clear that economic surplus may either increase or decrease following vertical integration or the use of vertical contracts, depending upon the underlying structural and behavioral conditions.

Nevertheless, there is considerable experience using competition policy to influence vertical coordination. For example, legislation exists in several countries concerning the use of two-part tariffs such as retailer allowances or discounts. Typically, such practices are not prohibited *per se*; rather, their use in a discriminatory manner is proscribed. Comprehensive legislation outlawing such discriminatory behavior exists in many countries including *inter alia*, the U.S., Canada, France, and Australia. The U.S. legislation (the Robinson-Patman Act of 1936) is particularly notable since it has been applied in the majority of cases to the

food sector (Burns, 1983). This act prohibits price discrimination or the use of promotional or other allowances relating to the sale of a good, if not accorded by the seller to all purchasers on proportionately equal terms. German legislation has also been explicit on what practices might distort competitive behavior in a vertical market. These include payments for first-time orders, regular stocking, shelf space, favorable credit terms, and an entry fee to a retailer for increasing the range of a supplier's product. Similarly, Article 85 of the EC's Treaty of Rome prohibits discriminatory practices which place non-favored purchasers at a competitive disadvantage.

There is no general consensus that such legislation has been wholly successful in serving consumers' interests. In a number of countries, e.g. the U.S. and Australia, legislation has been seen to restrict the competitive process and market entry, and the costs of compliance have been considered to be high (Monopolies and Mergers Commission 1981). Furthermore, it is not necessarily the intent of such legislation to directly preserve consumer welfare. In the U.S., the Robinson-Patman Act, for example, explicitly states that it exists to protect small businesses from the growth of large retail outlets. Such an objective is not necessarily commensurate with maximizing consumer welfare.

An interesting contrast to the U.S. situation can be found in the UK where no comprehensive legislation prohibiting discriminatory practices exists. In the Monopolies and Mergers Commission's 1981 report on discounts obtained by food retailers from manufacturing firms, the Commission found evidence of price discrimination in the food sector. However, while acknowledging the impact this would likely have on small retail outlets, it concluded that the lower purchase prices obtained by the large retail distributors

were generally passed on as lower consumer prices and, hence, were deemed to be in the public interest.

In sum, the experience of competition policy in several countries as it relates to vertical contracts is ambiguous since, even if it maintains a competitive framework corresponding to firm numbers, it has not necessarily been seen to best serve the interest of economic welfare.

#### **4. Summary and Conclusions**

Vertical coordination in the agro-food sector refers to transactional practices that tie price and output decisions between various stages within the system from up-stream basic producers, down-stream to final consumers. These practices can be classified into various types of governance structures, which in turn can arrayed or ranked according to the extent to which vertically interdependent entities behave independently or in concert. Within the sector there appears to be a trend toward the use of coordinating practices characterized by greater degrees of vertical cooperation or control, and proportionately less use of arm's length, spot market transactions.

Vertical coordination through contracts or integration can be motivated both by high transaction costs and by intra-sector externalities such as double marginalization. These result in independently-rational firm decisions that are suboptimal in terms of output and profits when viewed from the perspective of a vertical market structure. It is demonstrated theoretically that both vertical integration and vertical contracts which provide for a two-part tariff, such as the payment of a slotting allowance as a negative franchise fee, can result in welfare-enhancing market impacts. This outcome appears to be robust to a variety of



imperfectly competitive market conditions throughout the sector and to both fixed and variable proportions production technology. However, the choice between a vertical contract or integration may depend upon the nature of strategic interaction between rival firms.

It has been shown elsewhere that, with imperfect competition down-stream from farms, the welfare effects of agricultural policy reform are smaller than suggested by studies that (implicitly or explicitly) presume farmers sell direct to consumers. Not only does vertical coordination result in a welfare gain *per se* under imperfectly competitive conditions, the use of such vertical arrangements can mitigate the diminishing effects of imperfect competition on agricultural policy reform. Therefore, the concept of vertical coordination is potentially rich in implications for both market behavior and economic welfare in the agro-food sector.

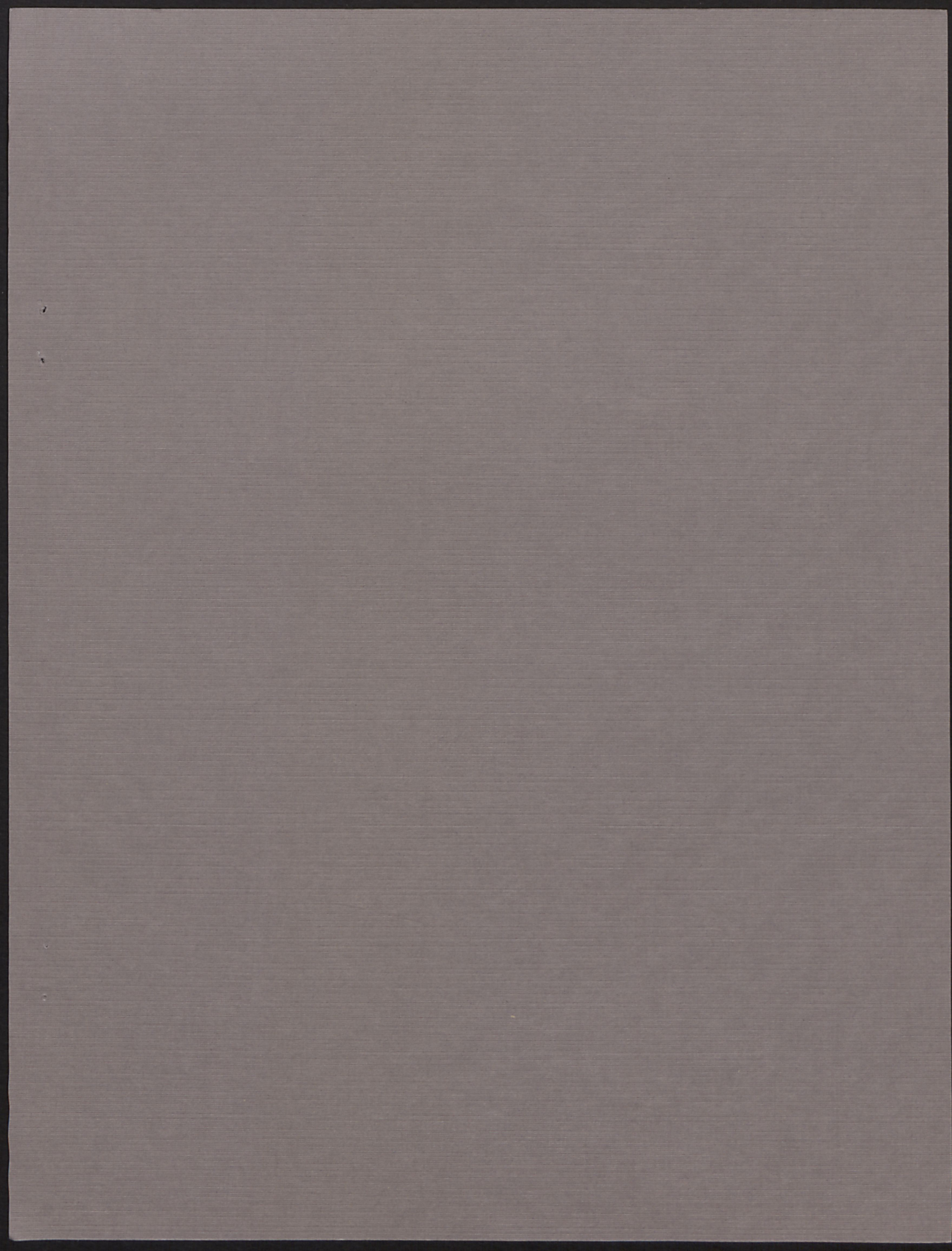
Competition policy in several countries has tended more often than not to proscribe vertical ties. In light of this analysis, it may be appropriate to reexamine the rationale for such restrictive policies on vertical contracts and integration.

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