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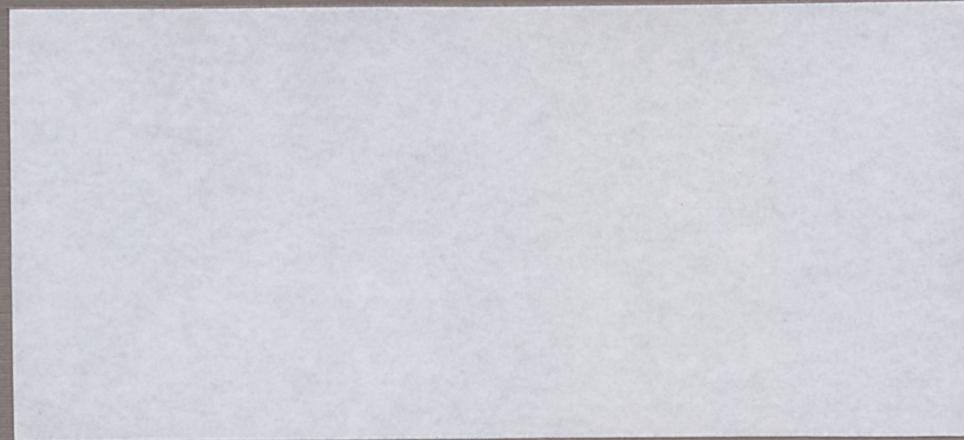
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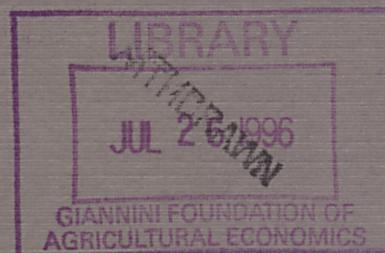
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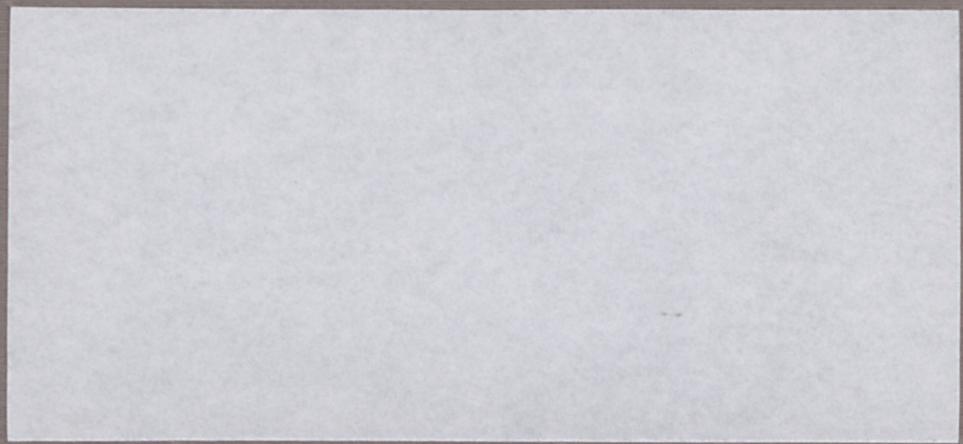
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**MANAGERIAL ECONOMICS**  
**OF VERTICALLY COORDINATED**  
**AGRICULTURAL FIRMS**

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## MANAGERIAL ECONOMICS OF VERTICALLY COORDINATED AGRICULTURAL FIRMS

The trend in agricultural markets is in favor of tighter vertical coordination where commodities are increasingly produced for a specialized end-use market. Forces that lead to differing exchange mechanisms and influence vertical coordination are not clearly understood, but recent theoretical progress provides novel explanations. Explanations based on transaction costs and strategic alliances logic substantially enrich the potential for understanding vertical coordination. The primary focus of the discussion is on vertical coordination from a managerial and business strategy perspective. Various categories of exchange arrangements are discussed, particularly at the producer-first handler level, and some conclusions are drawn regarding managerial choices for vertical coordination.

Differing vertical exchange mechanisms are observed across commodity marketing channels. For example, the poultry sector exhibits exchange mechanisms that result in relatively tight vertical coordination from upstream to downstream industries compared to the feed grains sector which relies primarily on open spot markets to coordinate vertically. The forces that lead to differing exchange mechanisms are not clearly understood, but interesting recent theoretical progress warrants renewed examination of this area. Theoretical progress has led to new contexts for analyses and allows novel potential explanations (Barry, Sonka, and Lajili). Ultimately, the desire is to be able to forecast which sectors will be vertically coordinated through increasing use of contracts or integration in the future and to assist in public policy and business strategy formation.

Understanding these alternative exchange arrangements, particularly at the producer-first handler level in the marketing channel, is an important economic problem. Various alternative exchange arrangements change the complex nature of transactions in regard to risk arising from different sources and also influence the efficiency of the marketing system. Also, from a managerial viewpoint, the choice among exchange arrangements can provide a competitive advantage or

disadvantage over rival firms and, over time, create entry barriers which may forestall new entrants to the industry or create exit barriers for the firm which make divestiture more difficult.

Consensus among observers is that vertical linkages in agricultural commodity marketing channels have been evolving to tighter coordination over several decades. The process typically has been termed the "industrialization" of agriculture (Godwin and Jones). Industrialization of agriculture in this context means that the undifferentiated products and open markets characterizing many agricultural commodity markets are evolving toward the differentiated products and contractual or integrated and controlled-supply markets usually characterizing manufacturing sectors of the economy.

In a recent article, Barkema, Drabenstott, and Welch referred to the "quiet revolution" occurring in vertical linkages throughout the food production, distribution, and marketing system.<sup>1</sup> As with most previous authors, they argue that changing consumer demand is driving the evolution away from open market coordination to tighter vertical linkages. Proliferation of production for specialized and relatively low-volume end-use food markets displaces a portion of the spot market transactions for the mass marketing of undifferentiated commodities. The trend is in favor of production for niche markets where a commodity is produced for a particular end-use prior to harvesting or sale.

The analysis here has a micro focus and concentrates on vertical coordination from a managerial perspective. That is, alternative exchange arrangements within commodity marketing channels are examined mostly from the viewpoint of managerial decisions. First, a definition of coordination and a review of various categories of exchange arrangements is presented. Next, possible theoretical explanations of forces that lead managers to various exchange arrangements are examined. Finally, some conclusions are drawn from the literature in the area.

### *Definition of Coordination*

The basic question of what is being coordinated arises when one examines the extent and nature of vertical linkages. At the producer-first handler level, the sources of risk include price, quantity, quality,<sup>2</sup> and timing of delivery (including storage and inventory, where appropriate). For example, sourcing a commodity input by processors includes managerial decisions regarding the quantity to be processed; the quality which is optimal for a particular facility to process given its complement of machinery, labor, and plant location; the timing of deliveries to the plant; along with the quality control and perishability aspects of the input. Risk is inherent in each of these decisions, and the exchange mechanism chosen for sourcing can directly influence managerial control and firm risk exposure.

Although each risk determinant may not accompany all commodity transactions, each exists to varying degrees across commodity marketing channels and across vertical linkages from upstream to downstream firms within a commodity marketing-food distribution channel. Substitute exchange mechanisms such as open markets, contracts, and vertical integration influence both the amount of risk from these sources as well as the distribution of risk. The exchange mechanism can have direct influence on the vertical transmission of risk. As a generalization, producers maintain the most independence and risk with open market exchange.

### *Types of Exchange Arrangements*

A continuum of exchange arrangements exists. At one end of the continuum are open markets which provide price as the primary coordinating mechanism. At the opposite extreme is complete vertical integration as an exchange arrangement which provides executive fiat and hierachial decision-making within a firm to resolve coordination issues across a market (Williamson, 1975; Masten). Numerous forms of contracts, some dependent on unique institutional structure, are along the continuum between these two extremes.

The Mighell and Jones classification of producer-first handler level contracts has been used by several authors (Sporleder and Holder; Schrader, et al; Barkema, et al; Wright).<sup>3</sup> Types of contracts, ordered by degree of producer control foregone, range from market specification through production management to resource-providing. Producers maintain the most control but also risk with the market specification contracts. The resource-providing contracts are regarded as vertical integration because often the ownership of the commodity being produced is with the integrator rather than the producer. Most of the control over the production practices and consequently most of the risk shifts to the integrator. Both production management and resource-providing contracts could be labeled as "quasi-integration" arrangements (Blois) from the viewpoint of a processor contracting for input because the processor seeks to influence coordination without assuming the risks and rigidity of all assets necessary for production of the input.

Another class of contract, common especially in grain markets at the producer-first handler level, attempts to reduce or shift price risk. These are referred to as "forward pricing" contracts and are classified as fixed-price and minimum-price.<sup>4</sup> Heifner and Wright estimated the effects of routine producer use of these contracts and reported that average producer revenues would change no more than plus or minus 3 percent, although revenue variability would decline modestly. These contracts can lead to complex strategies in managing price risk because they also can be tied to futures or options.

Other institutional arrangements influencing vertical coordination are marketing orders, bargaining cooperatives and marketing cooperatives. Marketing orders can be used to influence the allocation or flow of commodities to various markets and influence post-harvest quality (Armbruster and Jesse). Bargaining cooperatives attempt to coordinate quality and quantity of within-season supply as well as influence price in favor of producers, usually through countervailing market power on the processor side of the market. Bargaining cooperatives tend not to physically

handle the commodity, but some take title to enhance their control (Garoyan) and, therefore, their ability for achieving vertical coordination.

Marketing cooperatives that operate a pool usually require a contract, called a marketing agreement, between the cooperative and the producer.<sup>5</sup> Producers deliver all their production to the pool and thus transfer their individual marketing decisions to the cooperative (Hammonds). Because pooling operates in tandem with a marketing agreement, vertical coordination at the producer-first handler level can be enhanced.

Finally, there have been innovative proposals for institutional creativity regarding coordination at the producer-first handler level. Institutional schemes could be devised to facilitate coordination on an ex ante basis. Coordinating aggregate supply and demand at the producer-first handler level has been addressed primarily through the notion of an organized exchange for price discovery on a range of futures-like contracts calling for physical delivery (Holder and Sporleder; Shaffer). A forward deliverable contract market (FDCM) would facilitate sellers and buyers negotiating terms of trade prior to production, assisting in ex ante coordination of quantity supplied with quantity demanded. A FDCM essentially would be similar to a futures market in the sense that standardized contracts would be traded over an open exchange where prices would be publicly available. Such an institution would allow open markets to continue serving a coordinating function through price and rely on individual decisions. Shaffer recently renewed the call for a mandatory FDCM as a coordinating institution and its use as a substitute for government price support programs.

Before proceeding, a generic classification of vertical integration strategies for businesses, removed from the context of the producer-first handler level, is useful. Three generic types of vertical integration strategies may be identified (Harrigan). One is complete integration, where all of one input is produced or all of one output is transferred to a wholly-owned downstream firm. A second is taper integration, where firms source some fraction of an input from their own vertically-

linked operations and the remainder from market transactions. Forward taper integration involves the focal firm providing some fraction of one output to their own downstream operations but selling the remainder in spot market transactions. A third is quasi-integration, which is an attempt to influence vertically-linked firms without fully owning them. Quasi-integration includes a rather broad array of contractual arrangements such as those aimed at controlling inventory, delivery schedules, and buffer stocks. Forward quasi-integration would involve a contractual vertical linkage with a downstream firm in an attempt to influence behavior of the downstream firm regarding the output of the focal firm.

#### *Views of the Firm Relative to Vertical Linkages*

Fascinating theoretical developments have been made recently that add to the potential sophistication in understanding possible motives and strategies for managerial choice among alternative exchange arrangements. The highlights of these developments are addressed sufficiently by Barry, Sonka, and Lajili in this session. However, the target here is to briefly interpret these theoretical advances relative to vertical linkages within agricultural commodity marketing channels. Two views are compared, along with a third area-- strategic alliances, for implications concerning motives for establishing contractual or integrated vertical linkages.<sup>6</sup>

The conventional theoretical foundation for the firm is to view it as a production function. An alternative, based on Coase but elucidated and popularized by Williamson (1975), is to view the firm as a governance structure and consequently as a substitute for market transactions, rather than the firm having complete dependency on markets as in the production function view. A third area is strategic alliances, discussed as an emerging vertical linkage. Vertical interfirm alliances inevitably rely on a complex set of firm and managerial incentives and motives, but these can be analyzed in a transaction cost framework. This framework adds to understanding potential managerial motives for entering into strategic alliances as a vertical coordination mechanism.

### *Orthodox View*

The orthodox view of the firm as a production function provides considerable insight into managerial response to risk arising from price, quality, quantity, or timing of delivery. For example, among the managerial choices for firm response to risk are contracting, integration, adjusting input and/or output levels, storage, hedging, diversifying, time sequencing transactions, and insurance (Robison and Barry, pp. 64-65). Producers, first handlers, and downstream food manufacturers commonly engage in one or more of these responses.

Market power is a potential incentive for vertical integration. The possibility of firms gaining an advantage over rivals as a consequence of vertical integration across either factor or output markets is a traditionally-derived result from industrial organization theory (Tirole). As indicated by Henderson in a recent survey, four incentives for vertical integration based on market power can be identified. These include elimination of factor price distortions due to market power, elimination of successive mark-ups in the presence of imperfect competition, creation of entry barriers, and price discrimination (Henderson, p. 13).

One explanation for vertical coordination under the orthodox view of the firm has been the resource dependency argument. Resource dependency for a firm arises whenever one factor input represents a substantial share of total input or because upstream suppliers have discretion over the necessary factor input (Pfeffer and Salancik). At the producer-first handler, this phenomenon is observed for commodities such as livestock and vegetable processors. Risk, as the ultimate variable being managed through vertical coordination by firms, is the foundation for resource dependency arguments. However, empirical investigation of the relationship between resource dependency and vertical integration is complicated because risk may be an independent effect as well as the foundation for the resource dependency hypothesis (Krickx, 1990).

In a recent paper, Chavas constructs a model which incorporates cost-benefit analysis of vertical coordination through managerial decisions versus open markets. One important result of

this construct is that internalizing certain externalities can improve coordination of quality and timing. A substantial portion of perishable commodity transactions at the producer-first handler level are contract rather than open market. This approach indicates that motives for integration include externalities and/or market imperfections.

The relevance of these issues to commodity markets can be illustrated through the current concern over "captive supplies" of livestock. Taper integration upstream by meat packers results in procurement of some supplies through integrated feeding operations and procurement of some supplies from open market transactions. This raises questions about the incentives of the taper integrated firm and the ultimate performance at the producer-first handler level. Clearly, the incentives for contractual or integrated procurement by the packer may be to influence quality and timing of delivery. Thus, incentives for taper integration could include gaining a competitive advantage over rival firms through market power exercised in the input markets and/or simply lowering combined transaction and production costs through improving vertical coordination. The performance of livestock markets relative to taper integration is a current public policy issue.

#### *Transaction Costs*

Conceptualizing the firm as a governance structure and not just a production function leads to novel explanations for the firm's incentives for vertical integration (Williamson, 1981). This view adds refinement to understanding the managerial decisions involving the form of vertical linkages because emphasis is placed on elements which may interfere with open market provision of a factor input, such as opportunistic behavior. The influence of these elements ultimately rests on availability (quantity, quality, and/or timing) and costs. When faced with asset specificity, managers become aware of the potential for quasi-rent exploitation through opportunistic behavior. Open market procurement may not sufficiently guard the firm against quasi-rent exploitation and thus lead to contractual or integrated procurement as a substitute. Owning facilities for the production of an

input could result in lower procurement costs, but more fundamentally, the arrangement eliminates the possibility of opportunistic behavior being used to exploit quasirents. In general, the incidence of vertical integration would be greater for recurrent transactions when distinguished by asset specificity and risk (MacDonald; Williamson, 1979).

Asset specificity is ubiquitous among firms on both sides of the producer-first handler level. Specificity may occur in physical assets, human assets, or be site-created. Physical asset specificity, as measured by the difference between acquisition price and salvage value, is common in investments for farm production as well as processing machinery among agribusinesses. Once investment decisions are made, location specificity is created. Specialized knowledge and technology generate human capital specificity.

In essence, asset specificity may be viewed as a necessary but not sufficient condition for vertical integration. Open market procurement is generally an effective cost control measure. This aspect is surrendered in upstream total integration arrangements. Given a particular situation, the managerial decision to be weighed is potentially weaker cost control against lessened holdup possibilities. This calculation will not always favor integration. Moreover, Krickx (1991) cautions that transaction cost and resource dependency arguments as the motivation for vertical integration are difficult to separate since risk is rudimentary to both.

Perishability is a significant factor for commodities such as milk, fruits and vegetables, and to a lesser extent meat animals. Although data are sparse, producer-first handler contractual or integrated exchange arrangements are more common in perishable commodities than storable commodities (Harrington and Manchester, p. 15). The intrinsic vertical relationship among producer-first handler firms is changed by perishability from sequential dependency to reciprocal dependency. Sequential dependency distinguishes the vertical relationship among firms for storable commodities and coordination is facilitated through buffer stocks and the spot market often is sufficient in its coordinating role under such circumstances. Reciprocal dependency arises between production

and processor levels when farm production is perishable. Enhanced vertical coordination becomes necessary compared to spot markets and more complex exchange arrangements result (Boone and Verbecke). An analogous situation in the manufacturing economy is implementation of just-in-time delivery systems. A just-in-time arrangement requires relatively intricate vertical exchange mechanisms beyond the coordination provided by spot markets.

### *Strategic Alliances*

An interfirm alliance is any agreement for cooperation among independent firms designed to serve a strategic purpose. The collaboration leads to informal arrangements based on trust and involves a transfer or sharing of assets (Koenig and van Wijk). Strategic alliances as a vertical coordination mechanism are an intermediary form between vertical integration and spot market transactions. A strategic alliance also can include the more traditional and formal patterns of vertical coordination among firms such as contracts for sourcing or even partnerships.

Interfirm alliances arise from each firm offering unique assets to an alliance that are expected to be synergistic in an alliance framework. Alliances represent malleable vertical control compared to the rigid vertical control often present in contractual arrangements and always present in vertical integration. Alliances are often characterized by each firm to the alliance being a stakeholder but not necessarily a shareholder. That is, each firm has a stake in the outcome and performance of the alliance but firms do not necessarily become shareholders in the sense that they commit equity capital to a business entity, as common in joint ventures.

Other aspects of alliances are that they presume mutual obligation. Firms in an alliance tend to feel obligated yet the arrangement often is more flexible in that initiatives outside some original planned agenda are permissible or even encouraged. Alliances are thought to be sustainable when mutual asset specificity is developed between the firms which increases the opportunity cost of abdicating the alliance (Koenig and van Wijk, p. 173). However, alliances sometimes are

purposefully designed so that the exit costs are lower than other, more formal, forms of cooperation such as joint ventures.

Firms entering into strategic alliances is an inherent corollary of the transaction cost approach because the emphasis is on relative economic efficiency of the alternative forms for organizing economic activity, considering both production and transaction costs. The concept of an interfirm alliance is similar to Williamson's (1979) concept of relational contracts. Firms enter into alliances when they offer the potential of improvement over vertical integration or reliance on open market transactions. Applying transaction cost logic, increasing efficiency through mitigating risk by enhanced vertical control is offered both by contracts and vertical integration. In addition, vertical integration offers managers a means of safeguarding the firm from opportunism in either open or contract markets. However, managerial choice of vertical integration as a coordination strategy may be discouraged by relatively high idiosyncratic investment resulting from asset specificity. In addition, managerial choice in favor of open market or contractual transactions is confined by bounded rationality, which is exacerbated by general sector movement toward sophisticated production and processing technology, specification buying, and product differentiation. Thus, strategic alliances become a compromise managerial choice where optimization is anticipated among control, bounded rationality, and idiosyncratic investment.

Strategic alliances are becoming more common in agricultural commodity marketing channels. For instance, one large and relatively new meat packer in the Midwest has devised a scheme of strategic alliances which attempts to achieve vertical coordination primarily for purposes of product differentiation. The strategic alliances include collaboration with a proprietary firm that merchandises brand-name genetically-improved feeder pigs to market hog producers. The market hog producer agrees to buy specifically-sourced genetically-improved feeder pigs and contracts for market hog output with the packer. The packer offers premiums for these specifically-sourced genetically-improved market hogs. With the packing firm as the focal point, the scheme is to

vertically coordinate upstream in an effort to influence market hog quality and, to a lesser extent, timing of delivery. Plans call for the packer eventually to sell a branded product at retail and the exclusive tie with one genetically-improved seedstock source is an attempt to both control quality and differentiate output of the packer.

In a second similar example of strategic alliances within the same industry, another large packer contracts with producers for market hogs and provides producers with a list of acceptable seedstock sources. This packer has some experience with marketing branded red meat. Pivotal in the decision to launch a premium packaged meat product was a "joint development" agreement with a large grocery retailer, yet another strategic alliance. The alliance here is again noteworthy because it attempts to coordinate vertically from upstream supply source through to the market hog producer and downstream to the consumer level.

One incentive in both examples from a managerial viewpoint is to gain an exploitable first-mover advantage over rivals. If such alliances prove even moderately successful they could force, for competitive reasons, other packers into similar strategic agreements for either sourcing, product marketing, or both.

### *Summary and Conclusions*

The trend is toward tighter vertical coordination in agricultural commodity and food distribution channels. There are a myriad of managerial choices for vertical coordination. Potential explanation of the forces that lead to differing exchange mechanisms has been expanded through transaction cost and strategic alliances logic. Vertical transmission of risk and management of absolute risk is a fundamental motivation for many of the exchange arrangements observed at the producer-first handler level.

The nature of the vertical dependency relationship in agricultural commodity markets may be significant in understanding why transactions for some commodities are mostly spot market while

others are mostly contract. Sequential dependency and reciprocal dependency relationships are consistent with these patterns.

Some vertical relationships among firms in agricultural marketing channels appear to be consistent with the emerging literature on strategic alliances. Managerial choice of vertical integration as a coordination strategy is discouraged through relatively high idiosyncratic investment resulting from asset specificity. In addition, contractual transactions are constrained by bounded rationality. Interfirm alliances are a relatively new arrangement offering managers the opportunity of vertically optimizing among control, bounded rationality, and idiosyncratic investment.

Novel explanations and testable hypotheses surface from these new directions. Much empirical research remains to be done in an effort to understand both managerial motives and policy implications of vertical linkages.

### **Footnotes**

1. This article provides an excellent review of the consumer demand factors leading to tighter vertical coordination and the resulting consequences in agricultural and food markets and is a useful background for the discussion contained in the current manuscript.
2. Quality here is interpreted in the broadest terms. In this context it includes size, grade, type, color, and all other value-determining attributes of the commodity. Also, the general movement toward specification buying and product differentiation implies that firms increasingly desire to define their own unique value-determining attributes. The influence of this on vertical coordination is important. Exchange arrangements such as contracts and vertical integration facilitate coordination of such requirements.
3. Contractual forms more common at downstream levels as exchange mechanisms influencing vertical coordination include joint ventures and licensing. See Sheldon and Henderson for a recent analysis of licensing food products.
4. A futures contract is, of course, a forward pricing mechanism also. In the broadest sense, futures contracts could be viewed as a coordinating mechanism because of their role in shifting price risk. For purposes of brevity, futures as coordinating arrangements compared to cash contract or contracts on actuals are ignored here. See Leuthold; Schrader, et al and also Arthur for excellent discussions of this subject.
5. Marketing boards are another institutional arrangement aimed at achieving greater vertical coordination, among other things. The Canadian Wheat Board, for example, attempts to influence wheat supplies available to both domestic and foreign markets-- *ex ante* coordination of quantity supplied and quantity demanded. Currently, enabling legislation would be necessary before the U.S. could operate a marketing board patterned after the Canadian Wheat Board. For more discussion of marketing boards see Hoos. Also see Schrader, et al for an extended discussion of marketing cooperatives as a coordinating mechanism.
6. Numerous empirical studies add depth to understanding the nature of vertical linkages. Caves provides a comprehensive, although now a bit dated, review of empirical findings from both the business and economics literature, emphasizing business strategies of all types. Schrader, et al provide a summary and interpretation from the agricultural economics empirical literature in terms of vertical coordination. Henderson provides a recent interpretation of empirical literature in industrial organization as related to motives for vertical coordination. In the interest of brevity, these works are not summarized here.

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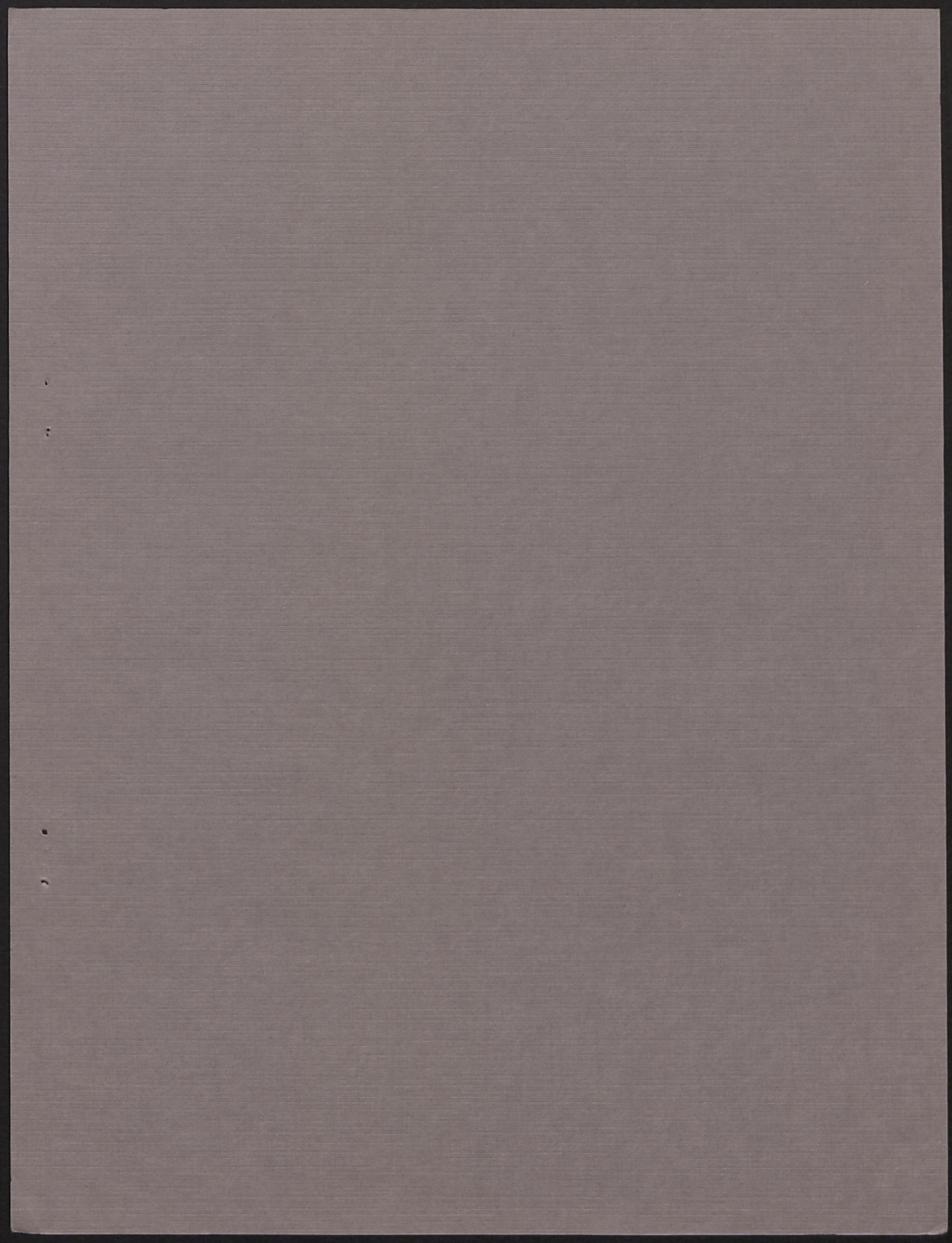
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