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SUPPLIER COMPETITION, UNCERTAINTY AND MAKE OR BUY DECISIONS

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Sloan School Working Paper #1773-86

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Organizations are frequently confronted with the decision to make or buy a good or service. Both prescriptive frameworks for managers (Culliton, 1942; Gambino, 1980) and economic theory (Williamson, 1975, 1981) have focused on cost factors as the most important determinants of make or buy decisions, although there are differences about how costs should be defined and which costs are relevant. In a previous paper (Walker and Weber, 1984) we examined the effects of two types of cost, transaction and production, on make or buy decisions and found that both types of cost influenced decision outcomes, although the hypotheses for transaction costs were only partially confirmed. In the present study, by introducing new data about the sample of decisions investigated and extending the theory of the original research, we elaborate on its findings, counter potentially confounding hypotheses, and identify more precisely the limits of its generalizability.

The make or buy decisions we study were made by managers in a division of a large US automobile firm for components of assemblies and subassemblies the division manufactured. All but two of the components in our sample were previously made or bought by the division, and all the components were either parts of new cars or replacement parts for old models. Therefore, the division faced the problem of managing potentially recurrent contracts with suppliers.

Williamson (1975:28) argues that, when the buyer and supplier constitute a bilateral monopoly and exchange is recurrent under stable market conditions, both firms may arrive at a contract that satisfies their interests, assuming that the contracting costs for each firm do not exceed the value placed on the exchange relationship. As uncertainty complicates the contracting situation, however, the costs of achieving such a contract increase substantially since its terms become more difficult to specify and performance more difficult to assess. When other suppliers are available to compete for the buyer's business and buyer switching costs are low, buyer transaction costs decrease because if the current vendor appears opportunistic, it will lose the business. In this study we examine effect on make or buy decisions of the interaction between market competition and uncertainty, controlling for comparative production costs, in contrast to our previous paper where we tested their effects independently.

Buyer Switching Costs

We assume that buyer switching costs were relatively low for the sample of components studied here for the following reasons (see Table 1). First, the components did not influence buyer capacity utilization for either capital equipment or labor. Second, the make or buy decision

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Insert Table 1 about here

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had virtually no consequence for vendor relations. Third, the components did not involve proprietary knowledge that gave the buyer a competitive advantage in its product markets. Last, the production of typical components in our sample, such as stamping parts and springs, required specialized dies that were owned by the division and, if the component was bought, installed in the outside supplier's manufacturing equipment. Thus, a major type of specialized asset associated with the contract was physical, owned by the buyer, and portable (Williamson, 1981, note 19).

Supplier Competition

Stigler (1968, chapter 4) states that the number of potential rather than existing vendors is the appropriate measure of competition. However, in a competitive bidding process for component purchasing (see Corey, 1978:18-26), such as that followed by the division studied here, the rules for designating potential vendors depend on the qualification process; and this process may vary across the components purchased. In the present study, therefore, a composite measure of supplier competition was created for each component from three indicators, as judged by the procurement manager of the division: 1) the extent to which there are enough potential suppliers to ensure adequate competition for the sourcing of a component; 2) the extent to which it is difficult to judge the competitiveness of outside quotes on a component; 3) the extent to which leading outside suppliers of the component possess proprietary technology that gives them an advantage over other suppliers. The last measure represents the possibility that one supplier may have developed a defendable advantage over other vendors in technologies that are related to the transaction but not necessarily specific to it.

Uncertainty

Furthermore, we measure two types of uncertainty associated with component production. First, similar to Anderson and Schmittlein's(1984) measure of uncertainty as the perception of sales force accuracy, volume uncertainty is indicated by 1) the extent to which significant fluctuations in the daily/monthly volume requirement are expected, and 2) the extent to which volume estimates are considered to be uncertain. When the supplier market is not competitive, unexpected changes in volume requirements raise contracting costs since there is no market to which the buyer can turn for relief from penalties imposed by the supplier. As these costs increase, the make option becomes more attractive than the buy alternative.

The second type of uncertainty concerns the technology of the product and is indicated by 1) the frequency of expected changes in specifications of the component and 2) the probability of future technological improvements of the component. Technological change implies retooling which, for the components in the sample, is paid for by the buyer whether the component is made or bought. Furthermore, if the product is bought, the supplier may have an opportunity to respecify the terms of the contract. When vendor market competition is low, the supplier may take advantage of this opportunity to exploit the limited alternatives available to the buyer which consequently must increase the effort it expends in contract specification and monitoring. As the costs of market contracting rise, in-house production should become a more attractive alternative.

Production Costs

Finally, the influence of comparative production costs on make or buy decisions should be significant (see Williamson, 1981; Walker and Weber, 1984). The magnitude of this effect should should not be different, however, across high and low competition supplier markets.

DATA AND METHODS

The sample consists of sixty decisions made by a formal make or buy committee composed of managers from purchasing, finance, sales, product engineering, manufacturing engineering and quality assurance. From the roughly twenty thousand part numbers the division used for assembly, the sample of sixty was referred to the make or buy committee because more information was required for a decision. The amount of information generated for the decision to make or buy these components was extensive and included a relatively precise comparison of buyer and supplier production costs. Therefore, although the sixty components constituted a convenience sample, they were chosen for analysis because of the scope and detail of the information available on them.

To minimize key informant bias (Phillips, 1981) we exploited the functional differentiation of the committee. For each of the sixty parts the purchasing manager answered questions concerning the level of market competition; the sales manager indicated the degree of volume uncertainty associated with each product; and the product engineering manager provided data on the level of technological uncertainty for each component. All responses were made on a Likert-type scale of 1 to 5. Make or buy decisions were coded 0 if make and 1 if buy. Comparative production costs were measured by the (natural logarithm of the) committee's estimate of the annual savings to make as opposed to buy a component. The annual savings to make estimate was used by the committee in making the decision for each component and was constucted to reflect internal transfer pricing policy.

The model representing the interaction of market competition and the two types of uncertainty was tested as a multiple indicator structural equation model (Bagozzi and Phillips, 1982) using LISREL (Joreskog and Sorbom, 1984) a full information maximum likelihood technique. This technique allowed us to examine the measurement properties of our data and the relationships among the constructs at the same time. In addition, we were able to test our hypotheses by examining changes in specific parameters while holding other parameters constant. Biserial correlations were computed for the relationships between the make or buy variable and the other variables for both high and low competition subsamples.

The parameters were estimated first on the complete sample of decisions undifferentiated by the level of market competition. Then the measurement parameters were estimated for the complete sample; but the causal paths between make or buy decisions, the types of uncertainty and comparative production costs, were allowed to vary across the high and low competition subsamples. A comparison of the full sample and split sample results allowed us to determine whether there were significant differences between the high and low competition cases.

RESULTS

The intercorrelations, means and standard deviations of the indicators of supplier competition are shown in Table 2a. The correlations, means and standard deviations of the other variables are presented in Table 2b. The parameter estimates for the model equating

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Insert Table 2 about here

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both measurement and structural equations across high and low competition subsamples are presented in Table 3a, and the estimates for the model with causal paths freed, but measurement relationships held constant, across subsamples are found in Table 3b.

Insert Table 3 about here

Table 3a shows that neither volume not technological uncertainty has a significant effect on make or buy decisions when the supplier market is not differentiated by the level of competition. The fit to the data of this model is good (χ^2=34.5, 27df, p=.15; normed incremental fit index=.95; non-normed incremental fit index=.84; see

Bentler and Bonett, 1980). The chi-square for the model in which supplier markets are differentiated according to their level of competition is 25.78 with 24 degrees of freedom, p=.365 (normed and non-normed fit indices, .99 and .89 respectively). The difference between the chi-square values of the two models is 8.7 with 3 degrees of freedom, p<.01.

Table 3b shows that high volume uncertainty leads to a make decision in low competition markets but not in high competition markets, as expected. In contrast, technological uncertainty has no significant influence on make or buy decisions when supplier competition is low but leads to a buy decision when competition is high. The influence of comparative production costs on make or decisions is significant in both subsamples.

In Table 4 we show the results of partitioning the chi-square difference between the two models into production costs and the two types of uncertainty. The chi-square difference for volume uncertainty is significant (p<.05), and the difference for production costs is not significant, as expected. Contrary to expectation, however, the difference for technological uncertainty is not significant.

Insert Table 4 about here

DISCUSSION

The results indicate that interaction between supplier market competition and uncertainty takes two forms. The first is that proposed by Williamson (1979): increasing uncertainty implies make as opposed to buy only when the supplier market is less competitive. This form is found for volume uncertainty. Suppliers seem to be unwilling to accept the operating costs due to changes in buyer volume and therefore increase the transaction costs of market contracting when volume changes occur. In a competitive market these costs are mitigated by the availability of alternative suppliers.

In the second type of interaction, increasing technological uncertainty leads to a buy decision when the market is more competitive. Because the components in our sample are not informationally complex and the buyer pays for retooling, the adjustment costs of administering technological change are apparently low enough that suppliers do not increase contracting costs over them, when competition is strong. Suppliers are less willing to incur these adjustment costs, however, when competition is weak.

These results suggest important distinctions among: 1) switching costs that are incurred by the buyer in changing suppliers; 2) adjustment costs that are incurred by either the buyer or supplier in response to changes in volume or product specifications; and 3) transaction costs which, as they are related to vertical integration decisions, are typically experienced by the buyer as a result of opportunistic supplier behavior. When market competition is low, supplier adjustment costs caused by changes in volume requirements raise transaction costs more than adjustment costs caused by changes in product specifications. This difference may be due to the relative simplicity of the components and the arrangement whereby the buyer owns the dies used in component production and pays for all retooling. These important context factors are undoubtedly solutions to past contracting problems regarding technological change.

Future research on the effects of uncertainty on the scope of activities performed by the organization should therefore specify how types of uncertainty are related to variations in the informational and historical contexts of the contracts in which the firm is engaged. Such an approach might begin to address the conflict between the power and efficiency perspectives on organization (see Chandler, 1982; Perrow, 1982; Williamson and Ouchi, 1982) by allowing a firm to behave efficiently and opportunistically at the same time with different trading partners, depending on the conditions of the contracting relationship. The ensuing problems then become modelling the development of contracting practice over time and aggregating contracting behavior to characterize the organization or subunit as a whole.

The findings of the present study are limited not only by the small sample size but by the strong contextual constraints outlined above and presented in Table 1. Varying these constraints by collecting data from other divisions or firms, in the U. S. or outside it, would most likely lead to different results. It is hoped, however, that these results would complement rather than contradict those of the present study.

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TABLE 1

Characteristics of Decisions Studied

		MEAN	STD DEV
1.	Extent to which decision significantly influences utilization of existing capacity in division. (1 - NO EXTENT, 5 = VERY GREAT EXTENT)	2.0	.66
2.	Extent to which decision significantly influences utilization of existing labor force in division.	2.2	.51
3.	Extent to which decision significantly influences vendor relations concerning other parts. (1 = NO EXTENT, 5 = VERY GREAT EXTENT)	1.82	.83
4.	Extent to which division possess proprietary technology leading to a competitive advantage concerning product. (1 = NO EXTENT, 5 = VERY GREAT EXTENT)	1.78	.64

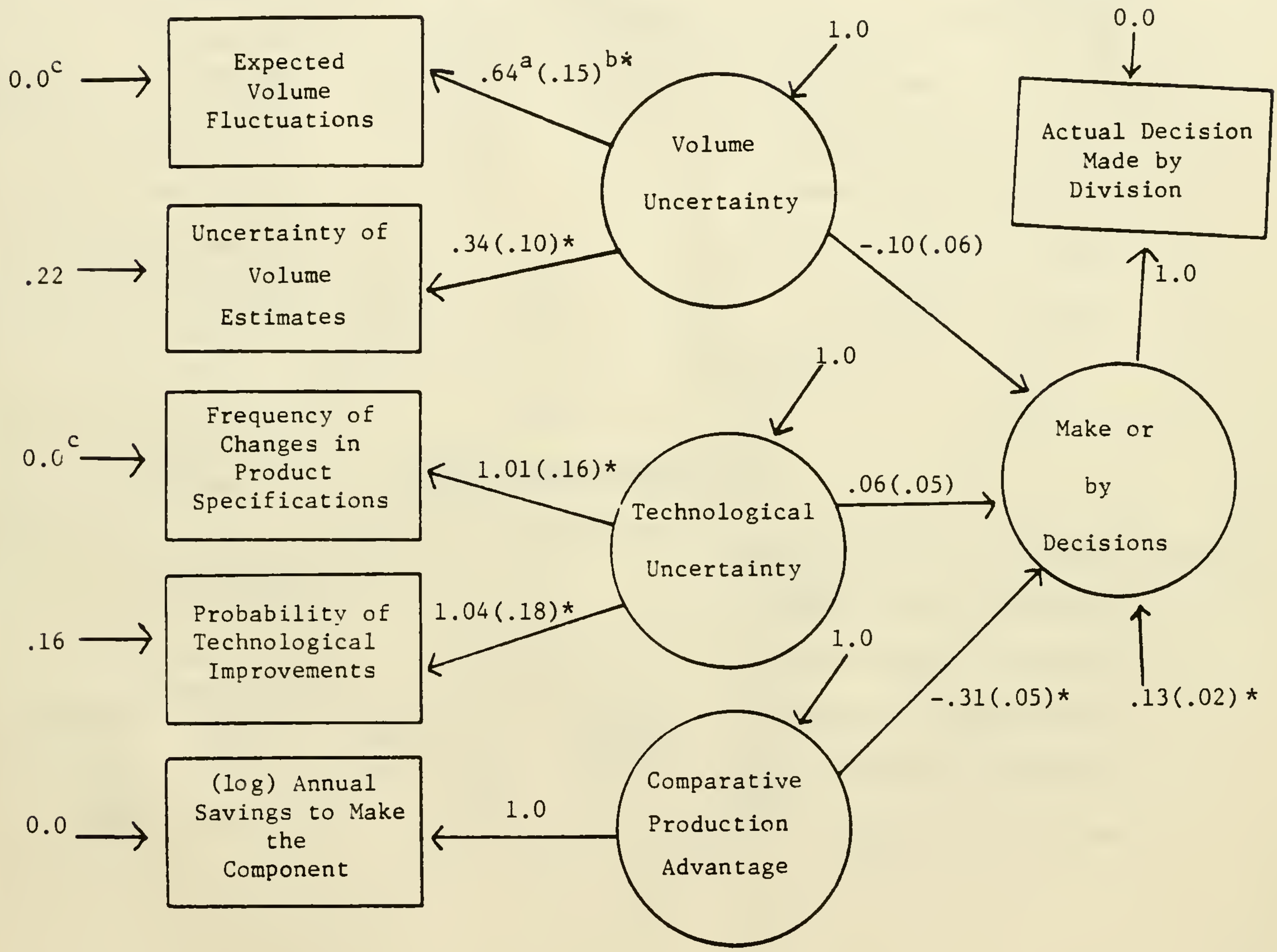
TABLE 2

A. Means, standard deviations and correlations for the indicators of supplier market competition

Indicator	Mean	Std. Dev.	Product Moment Correlations		
1. Difficulty of judging competitiveness of outside quotes	2.78	.83	1.0		
2. Number of potential suppliers to assume adequate competition	2.95	.91	-.82	1.0	
3. Extent to which leading outside suppliers possess proprietary technology	2.87	.96	.56	-.61	1.0

Table 3

A. Results of LISREL tests for full sample (correaltions among exogenous variables omitted for simplicity)



[a]Unstandardized estimates are reported.

[b]Standard errors are presented in parentheses

[c]Because in the initial test of the model, negative estimates of the error variances were produced, most likely due to the small sample size, Rindskopf's (1983) procedure was employed to fix the lower bound of the variances at zero.

*/critical ratio/ greater than 2.

B. Means, standard deviations and correlations for the indicators of volume uncertainty, technological uncertainty, comparative production costs and make or buy decisions.

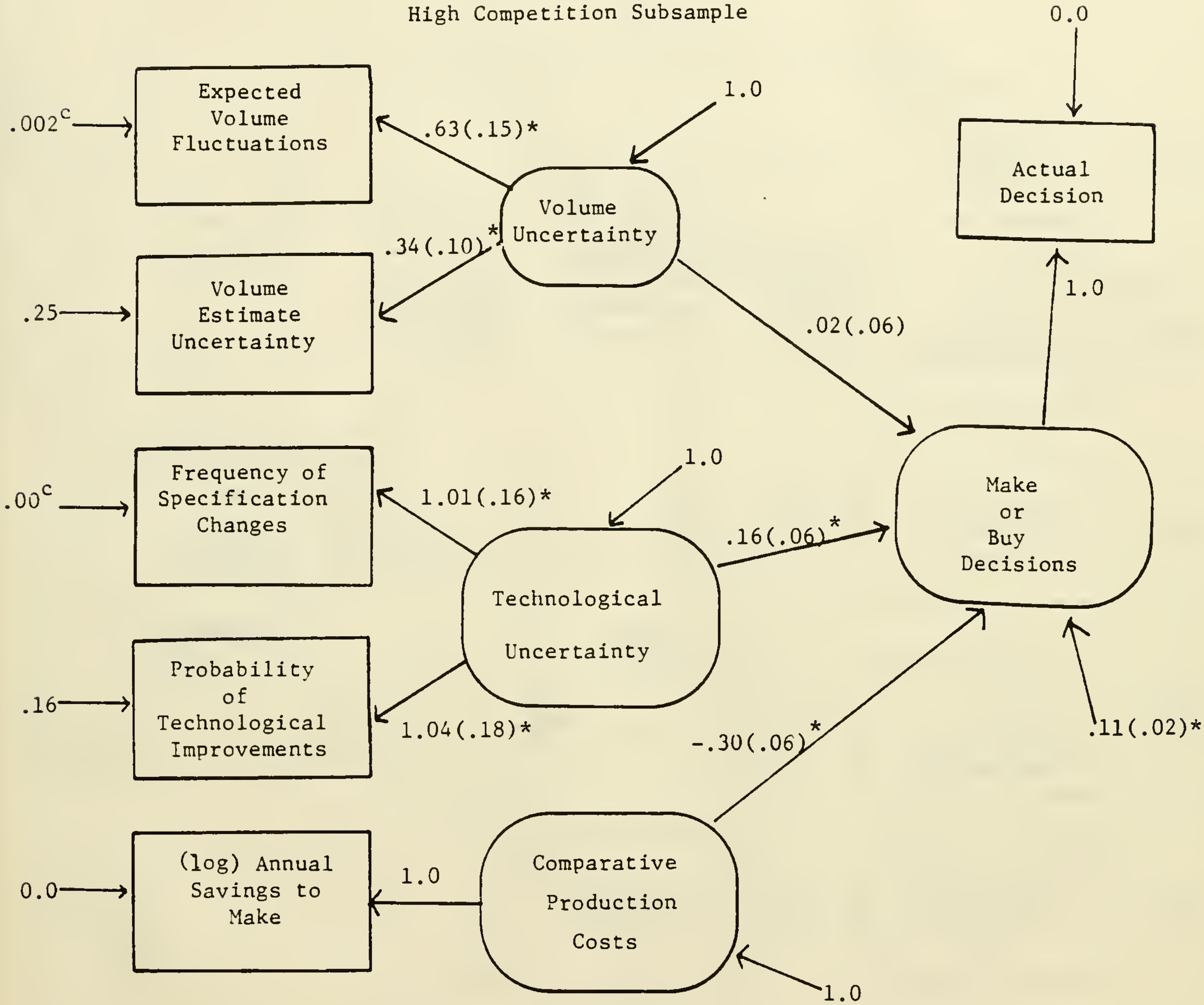
High Competition Subsample

Indicator	Mean	Std. Dev.	Product Moment Correlation				
1. Expected Volume Fluctuations	2.87	.63	1.0				
2. Uncertain Volume Estimates	2.93	.52	.39	1.0			
3. Changes in Specifications	2.62	1.02	-.25	-.32	1.0		
4. Technological Improvements	2.59	1.09	-.14	-.24	.92	1.0	
5. Comparative Production Cost	5.41	4.98	.18	.13	-.22	-.24	1.0
6. Make or Buy Decisions	.5	.51	.13	.0	.44	.38	-.65

Low Competition Subsample

Indicator	Mean	Std. Dev.	Product Moment Correlation				
1. Expected Volume Fluctuations	2.87	.63	1.0				
2. Uncertain Volume Estimates	2.9	.61	.78	1.0			
3. Changes in Specifications	2.5	1.01	.11	-.14	1.0		
4. Technological Improvements	2.5	1.14	.15	-.13	.95	1.0	
5. Comparative Production Cost	7.36	5.39	.35	.25	.04	.04	1.0
6. Make or Buy Decisions	.4	.49	-.60	-.39	-.09	-.08	-.69

B. Results of LISREL tests for high and low competition subsamples (Correlations among exogenous variables omitted for simplicity)



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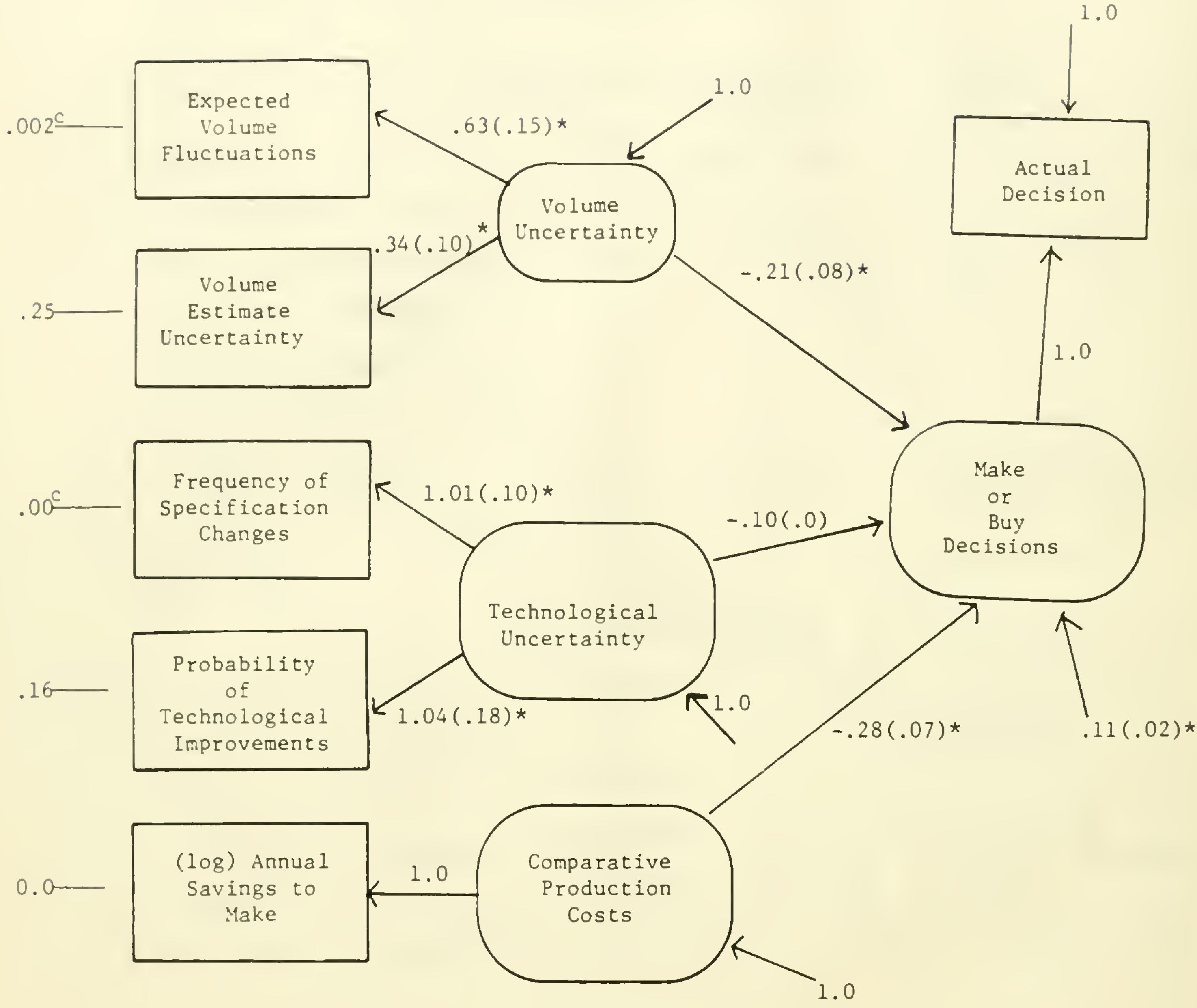
*/critical ratio/ greater than 2.

Low Competition Subsample



*/critical ratio/ greater than 2

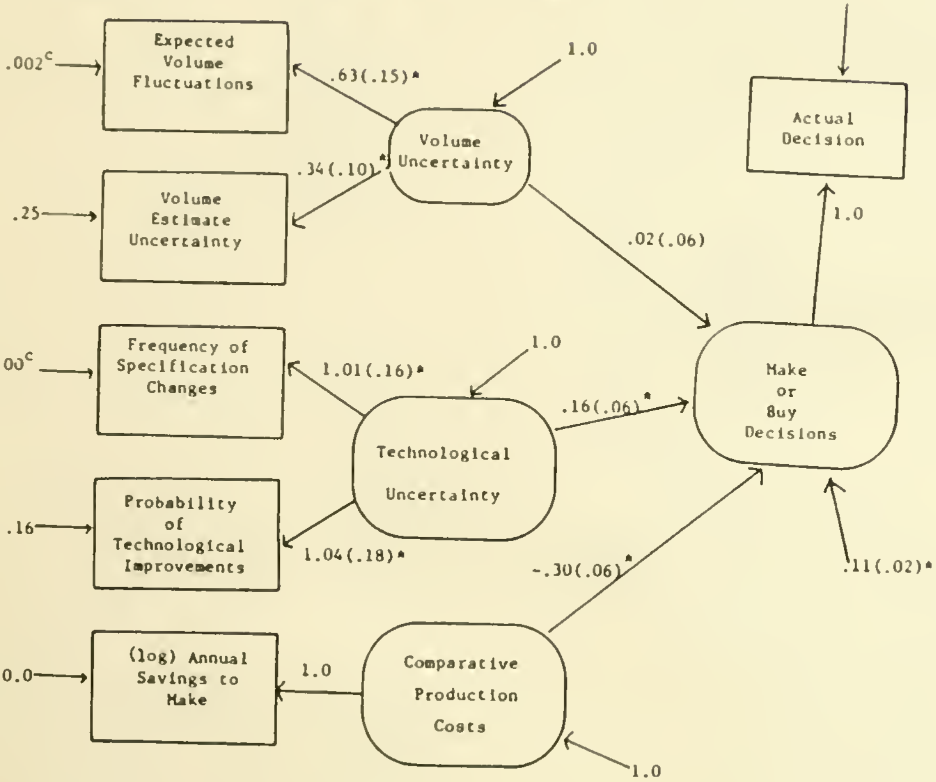
TABLE 4

Chi-Square Difference Tests for Causal Paths

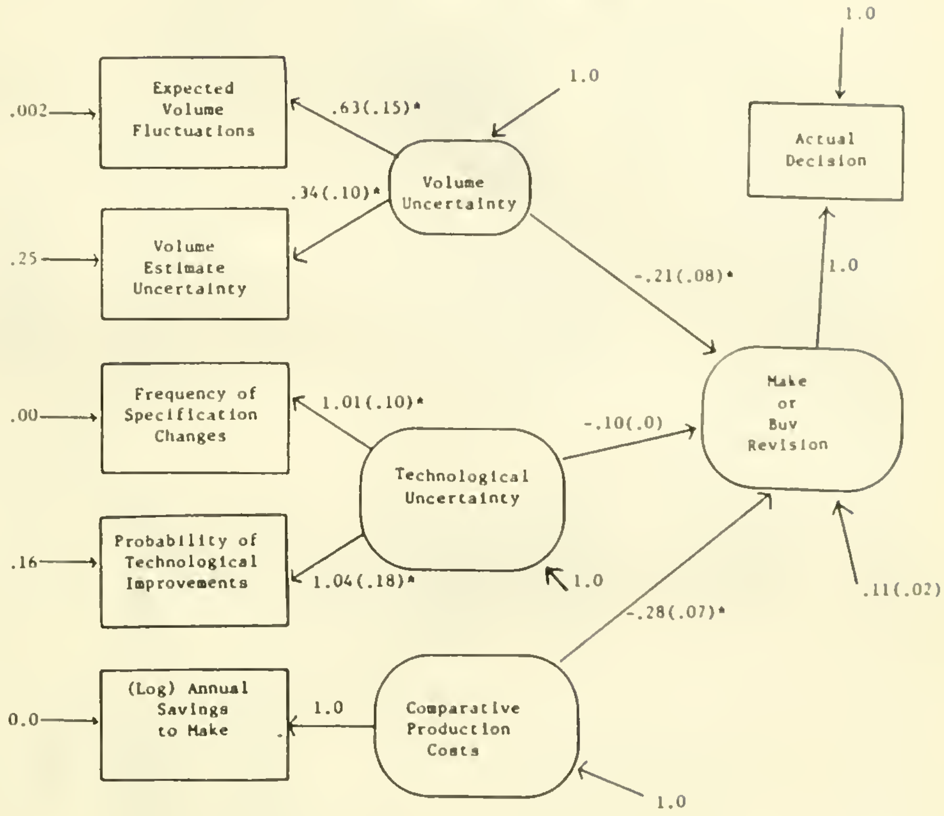
	Chi-Square for Model With All Parameters Fixed Across Subsamples	Chi-Square for Model With Causal Path Free Across Subsamples	Chi-Square Difference Between Models	Significance	Degree of Freedom
Volume Uncertainty	34.5	29.8	4.7	$p < .05$	1
Technological Uncertainty	34.5	32.2	2.2	NS	1
Production Costs	34.5	34.47	.03	NS	1

B. Results of LISREL tests for high and low competition subsamples (Correlations among exogenous variables omitted for simplicity)

High Competition Subsample



Low Competition Subsample



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