Forward Integration into Distribution: An Empirical Test of Transaction Cost Analysis

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1. INTRODUCTION

The issue of forward vertical integration has attracted a good deal of attention from researchers in several disciplines, including economics, marketing, and law. Many explanations have been offered for this phenomenon, including technological interrelationships involving economies of scale and scope (Chandler), uncertainty and risk considerations (Arrow, 1969), information externalities (Green), and strategic purposes. Blair and Kaserman (1983) offer an extensive survey of the extant literature in this area.

Of particular note, however, is the recent rise in prominence of the transaction costs analysis (TCA) of vertical integration. This approach consists of a blend of institutional economics, organizational theory, and contract law, and has been developed primarily by Oliver Williamson (1979, 1985). He views vertical integration as a response to the inability of arms-length market relationships to govern exchange efficiently under particular circumstances. The level of specialized assets[1] required to support the exchange, the uncertainty[2] surrounding the exchange, and the frequency[3] of exchange are

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1. Specialized assets are those investments in physical and/or human assets that have very limited salvage value outside the focal exchange.

2. Uncertainty refers to the condition of being unable to predict relevant contingencies.

3. Frequency refers to the distinction between one-shot exchange and recurrent exchange. We shall not deal with this variable here since we are interested only in recurrent exchange.

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identified as the principal factors that make market-mediated exchange inefficient.

Despite the increasing use of the transaction cost approach to explain forward integration, empirical tests of this line of reasoning are few. Some of the more prominent include make versus buy decisions in component sourcing (Monteverde and Teece), integration of the selling function (Anderson and Schmittlein), shipper-carrier relations (Palay), integration in the aluminum industry (Stuckey), and aerospace contracting relations (Masten). For a summary of these and other empirical TCA studies of long-term contracting, see Joskow. Clearly, there is a need to assess the validity of the particular propositions offered by TCA concerning vertical integration. Such evidence would advance our conceptual models by pinpointing areas of needed refinement, as well as begin to shed light on the diverse choices made by firms regarding forward integration.[4]

In this paper we present an empirical test of TCA propositions concerning forward integration by surveying a sample of industrial goods manufacturers. The variables implicated by the theory are measured via a questionnaire directed at a key informant within each firm. The resulting data are subjected to multiple regression and multinomial logit analysis to assess the degree of support for the predictions.

The remainder of the paper is divided into five sections. In section 2 we describe some of the institutional detail regarding industrial marketing channels and distinguish the principal alternative configurations. In section 3 we develop the link between forward integration and each of the key variables in transaction cost analysis. In section 4 the measures and data collection procedures are described. In section 5 we report the results of the analysis, and section 6 closes the paper with a discussion of the implications of the study.

2. DISTRIBUTION CHANNELS FOR INDUSTRIAL GOODS

One of the principal requirements for conducting an empirical investigation of TCA predictions is a high level of microanalytic detail concerning the alternative institutional arrangements. We begin by describing the organizational forms of distribution channels found in industrial goods markets.

The classification of channel structures in industrial markets is made difficult by the overlapping structures and inconsistent terminology found in the literature; see Stern and El-Ansary for a general discussion of distribution channels. Nevertheless, following Haas, Diamond, and Sutton, we can isolate

4. With respect to this diversity of choices, the available data (U.S. Bureau of the Census) show that industries vary considerably in their degree of forward integration. Further, casual observation reveals that such diversity extends to firms within industries as well.

two categories of channel organizations that differ with respect to the degree of forward integration. These researchers generally classify the various alternatives into direct and indirect channels. In the direct channel, the firm does not employ an independent reseller. Rather, it retains ownership of the product until it passes to the end-user. All of the downstream tasks are undertaken directly by company employees or else by such commission agents as manufacturers' representatives. The key attribute is that only the firm has any claim to residual profits.

The indirect channel classification comprises a bewildering array of institutional structures. The firm sells to independent resellers (such as distributors, wholesalers, retailers), who in turn resell the product to end-users or other resellers. These indirect channels vary by the type of intermediaries involved and the number of levels present within a particular system. Indirect channels are often "referred to collectively as distributors" (Sutton). Stern and El-Ansary provide a detailed description of several different types of distributors within the channel. All these indirect channels involve downstream firms that actually purchase the product and resell it. Since they take title to the product, residual profits are not claimed exclusively by the manufacturer.

From the standpoint of TCA, it is evident that direct channels represent relatively more forward integration than indirect channels. Thus, TCA predictions about vertical integration essentially speak to the choices made by manufacturers regarding direct versus indirect channels. As a recent survey of industry practice (Sutton) found, most firms can and indeed do use both direct and indirect channels simultaneously. A good illustration of multiple channels is IBM's using Computerland (a reseller) as a channel intermediary while making direct sales to end-users. Marketing specialists consider the multiplicity of channels and the management of these systems to be a critical managerial task (Stern and El-Ansary).

Multiple channel usage makes it infeasible to adopt the basic research design used in previous TCA studies. These studies typically have focused on only two disjunct categories representing the integrated and nonintegrated options. For instance, Anderson studied the internalization of the selling function in electronics firms by comparing sales territories serviced by sales branches with those serviced by commission agents. Overlapping territories where employee sales forces and commissioned agents operate concurrently were consciously excluded from the estimation sample. Likewise, when Monteverde and Teece and Walker and Weber compared the make versus buy decision for components, they excluded components that are both purchased and manufactured at the same time from their data. By contrast, we will examine indirect and direct channels used by industrial manufacturers, allowing for the possibility that these channels may be used simultaneously by some firms.

3. TRANSACTION COST ANALYSIS OF RESELLERS IN DISTRIBUTION CHANNELS

According to TCA, the firm's decision to use resellers is made on the basis of comparative institutional efficiency, In particular, it ascertains which of the alternatives constitutes the transaction-cost-minimizing condition. Such costs are distinct from production costs and are the "costs of running the system" (Arrow, 1969). Searching for information, bargaining, monitoring, and contract enforcing are all instances of these costs.

To some degree, transaction costs have earned the reputation of being capable of explaining anything in a post-hoc fashion because they have not been defined in an operational fashion. This state of affairs has been alleviated, however, by Williamson's (1979, 1985) elaboration of this approach. He provides testable implications of transaction-cost-minimizing analysis by elaborating the links between key attributes of transactions and institutional structures. Based on transaction costs logic, one can then match attributes of transactions with institutional structures that minimize these costs. Each of these attributes of transactions is discussed in turn below.

3.1. ASSET SPECIFICITY

This significant attribute of transactions refers to the extent to which specialized or nonredeployable investments are needed to support an exchange. Example of such investments include railcars specialized to haul one brand of automobile (Palay), refrigerated trucks needed to ship unpasteurized beer, specialized software that communicates only with one firm's computers (Jackson), and dedicated production equipment (Monteverde and Teece).

Specialized human assets are also present to varying degrees in distribution channels. The time and effort employed to acquire firm-specific knowledge needed for downstream activities is perhaps the most common form of these investments found in distribution channels (Heide and John). Notice that such knowledge becomes largely useless if the relationship terminated.

A high level of specific assets has profound implications for forward vertical integration. The primary consequence is to expose the transaction in question to opportunistic behavior. Because nonredeployable specific assets make it costly to switch to a new relationship, the market safeguard against opportunism is no longer effective. The other party can expropriate the value of quasi-rents associated with these assets. Presumably, rational firms would not invest in them unless they could be safeguarded.

According to TCA, the ultimate safeguard for specific assets is to internalize the transaction in question. Vertical integration provides a safeguard because of (a) the better monitoring and surveillance properties of organizations relative to markets, and (b) the reduction of profits from opportunistic behavior

since employees do not ordinarily have claims to profit streams. In the context of forward integration into wholesaling and/or retailing, the safeguarding of specific assets will involve internalizing the functions of independent resellers. We can summarize this as the following testable proposition:

Proposition 1. As the levels of specific assets needed to support distribution activities are increased, industrial firms will rely more heavily on direct channels.

3.2. Uncertainty

Williamson (1985) implicates uncertainty as the other principal factor involved in forward vertical integration decisions. Fundamentally, an inability to predict contingencies creates problems in writing contracts because these agreements are incomplete in some important respects. When unforeseen contingencies arise, market contracts experience strain in adapting to the changed circumstances because opportunistically inclined parties can try to interpret unspecified clauses to their own advantage. (It is important to note that contractual incompleteness is attributable to the limited cognitive capabilities of human actors.)

In a distribution channel it is evident that *environmental uncertainty* can exist with respect to many marketing activities, such as sales targets and promotional activities to support the introduction of new products. Clearly, institutional structures that permit sequential, adaptive decision making are needed when such uncertainty increases. Marketing specialists (Shapiro, Anderson and Weitz) have argued that one of the principal drawbacks of dealing with independent intermediaries is the difficulty of renegotiating agreements in light of changed circumstances. Similarly, organizational researchers (Stinchcombe) have shown that relationships incorporate more elements of hierarchy in response to increrases in uncertainty.

Transaction cost analysis posits that an appropriate response to increased environmental uncertainty is to internalize the transaction. First, vertically integrated structures permit sequential, adaptive decision making to proceed more smoothly because of administrative mechanisms. Authority structures permit quicker resolution of conflicts arising from differing interpretations of evolving circumstances. They enhance the information flow between the parties, thus enabling them to react better to the uncertainties. To summarize this as a testable proposition, we have:

Proposition 2. As downstream environmental uncertainties increase in industrial goods markets, manufacturers will rely more heavily on direct channels.

In addition to environmental uncertainty, Williamson (1985) introduces the notion of *behavioral uncertainty.* Unlike environmental uncertainty,

which is exogenously imposed on the exchange, behavioral uncertainty arises within the context of the exchange itself due to the opportunistic inclinations of the transacting parties. Behavioral uncertainty refers to the difficulty of ascertaining the actual performance or adherence to contractual agreements. Stinchcombe has discussed in some detail the impact of such performance assessment difficulties on the structure of commercial relationships.

Behavioral uncertainty can take the form of false claims by downstream resellers that they have executed faithfully some agreed-upon channel activity (such as shelf stocking or cooperative advertising) while they simply pocket the remuneration for the activity or else save the costs of undertaking it. In such circumstances, greater control over reseller activities is desirable. While (costly) supervision can effectively reduce such blatant opportunism, a subtler problem arises when there are long lags between actions and market responses. Such lags in the downstream selling environment make it difficult to infer which actions were responsible for the observed outcomes. Related as such behavioral uncertainty is to performance issues, we advance the following proposition:

Proposition 3. As performance assessment difficulties in downstream activities increase, manufacturers will rely more heavily on direct channels.

3.3 Production Costs

Although TCA tends to downplay the significance of production costs and related technological effects on forward integration, the object, nonetheless, is to minimize the sum of transaction and production costs in making forward integration decisions. Following Williamson's (1985) treatment of these effects, we argue that larger firms will tend to integrate their channels more readily than smaller firms when economies of scale or scope are substantial. Summarizing, we have the following testable proposition:

Proposition 4. Industrial manufacturers who can exhaust economies of scale will rely more heavily on direct channels.

It should be noted that the above prediction is identical to that proposed by marketing specialists (Haas; Stern and El-Ansary). Their reasoning is quite different, however. Rather than relying on the assumption that firms strive to minimize transaction and production costs, they argue that firms will generally prefer to internalize activities wherever possible. Since larger firms are better able to afford the set-up costs involved, they will use direct channels more often. As the leading marketing channels textbook notes, independent resellers "exist only by virtue of the fact that suppliers and/or customers . . . cannot afford to integrate, and therefore must rely on such intermediaries. . . ." (Stern and El-Ansary: 129). TCA maintains that what matters is not whether the firm can afford to integrate but whether there is

an incentive to integrate. In contrasting the two explanations, we would argue that the TCA reasoning is more appealing since it does not assume that firms are motivated to internalize activities as a general tendency. The justification for such an assumption derives from the power-oriented perspective on firm behavior developed by organization theorists. Since we are concerned with firm behavior in competitive markets, it seems more reasonable to invoke an efficiency perspective. Nevertheless, it should be stressed that the present study cannot rule out either explanation, should a firm size effect be found in the data.

4. EMPIRICAL STUDY

4.1. RESEARCH DESIGN

A principal consideration in testing the TCA predictions advanced in the previous sections involves the operationalization of the dependent variable, vertical integration. Since the theory predicts that increasing levels of asset specificity and uncertainty result in greater forward integration, it becomes important to isolate a set of structures that can be unambiguously ordered with respect to the presence of forward integration. We accomplish this by examining industrial manufacturers and classifying their downstream channels into direct and indirect systems. The direct channel represents forward vertical integration. Since firms often utilize both kinds of channels, a quantified measure of the extent of forward integration is provided by assessing the fraction of that firm's sales going through the direct channel.

It should be stressed that this test involves a semi-microanalytic level of detail. We have ignored the institutional variation that exists within the indirect channel itself. Resellers can vary greatly in the degree to which vertical control is imposed on them by the upstream firm. For instance, an authorized dealer of a firm is likely to have far less discretion than a merchant wholesaler. Nevertheless, since they are both resellers who take title to the product and claim residual downstream profits, they are considered equivalent in our classification scheme.

To summarize, we intend to test the TCA predictions involving forward integration by examining industrial marketing channels. We focus on the use of direct versus indirect channels and classify those firms that use both types simultaneously as using "mixed" channels. The fraction of sales going through the direct channel is a quantified measure of the firm's position on the continuum of internalizing downstream activities.

4.2 SAMPLE

The data reported here are obtained from a sample of industrial firms with sales over $50 million. The sample was drawn from a list of firms maintained

by a commercial vendor. The responses of eighty-seven industrial goods firms constitute the data for estimating our models. An examination of the sample characteristics (table 1) reveals that there is substantial variation in the type(s) of channels used, ranging from exclusively direct to exclusively indirect, with the majority of firms drawing to some extent on both direct and indirect channels. The variety of products sold is very broad, including equipment, components, and operating supplies. This sample appears quite comparable to recently published marketing studies of channel types (Lilien, Coughlan). Despite the diversity of this sample, it should be emphasized that it is a nonrandom sample. The commercially available list used as our sampling frame may contain biases of unknown magnitude. We stress the need to cumulate evidence from multiple studies.

4. 3. METHOD

As the study concerns organizational-level decisions, a key informant survey was used to gather data. In this approach, the researcher uses one individual in each organization who is knowledgeable about the issues at hand and reports on behalf of the organization. These individuals are not selected at random from each organization. Rather, they are deliberately selected to be key informants by virtue of their position within the firm; see John and Reve for a detailed discussion of this approach.

The informants in this survey were sales managers. We can justify their choice on the following grounds. Decisions about channels typically reside at a reasonably high level within the sales function of a firm since the sales staff is the locus of contact between the focal firm and the downstream intermediaries. Further, channels decisions are not made for individual prod-

Table 1. Sample Characteristics

Measure	Average
Percentage of sales through direct channel	61%
Specific assets (Time required for new hire with prior experience to become familiar)	8.4 months
Environmental uncertainty (Average across 5 items on a 5-point scale response format)	3.0
Behavioral uncertainty (Typical time from initial contact to order placement)	4.6 months
Territory sparseness (Percentage of salesperson's time spent on travel)	23.0%
Annual sales	$133.4 million

ucts; rather, they are made for a line of related products. With these considerations in mind, it was felt that an appropriate key informant would be the sales manager in charge of a product line. Individuals in these positions are likely to be extremely knowledgeable about the downstream distribution function.

As described earlier, a commercial list of sales managers in firms with annual sales over $50 million was purchased and was used as the mailing list for the study.[5] A postcard was mailed to each of the individuals on the mailing list asking the firm to participate in the study. As an incentive to participate, the sales managers were told that a summary of the results would be provided to them. The survey instrument was developed with the assistance of on-site interviews with sales managers in about a dozen firms, who responded to an initial version of the questionnaire and gave us feedback that enabled us to identify potential problems with the questionnaire. After making the necessary changes, the final questionnaire was mailed to all the individuals in the sample who agreed to participate.

4.4. Measures

Each sales manager was asked to complete the questionnaire for a distinct self-selected product line; all the questions were answered at the level of this product line. The specific questions used to measure each of the variables involved in the propositions are described below.

4.5. Channel

The use of resellers was captured by responses to the following question:

What percentages of sales are made to the following types of customers?
_____ end users
_____ channel members (wholesalers, distributors, retailers)
100% total

The percentage sold to end-users (% DIRECT) constitutes the amount going through a direct channel. Sales to channel members represent the use of resellers.

4.6. Specific Assets

In order to measure this variable, we capitalize on the notion that products requiring a good deal of training and experience specific to the line represent situations where specific assets are present. This was measured with the following item:

5. The list included both industrial and consumer goods firms. Only the responses of the industrial goods manufacturers are analyzed here.

How much time is required for a newly hired salesperson with *experience in the industry* to become adequately familiar with your products and customers?
_____months.

This measure (SPSKILLS) does not measure the overall level of skill needed; rather, only the nontransferable component is measured. It specifies a person with prior experience in the industry. To the extent that the skills are transferable, such an individual would not need much time to adapt to this situation. This measure is similar to one used by Anderson.

4.7. Environmental Uncertainty

The inability to predict relevant contingencies is measured with the rating scale items described below. These items capture the extent to which the downstream marketing environment is volatible and turbulent.

How would you describe these products compared to other products in general?

Stable market shares	1	2	3	4	5	Volatile market shares
Easy to monitor trends	1	2	3	4	5	Difficult to monitor trends
Stable industry volume	1	2	3	4	5	Volatile industry volume
Sales forecasts are quite accurate	1	2	3	4	5	Sales forecasts are quite inaccurate
Predictable	1	2	3	4	5	Unpredictable

The measure (ENVUNCT) was formed by computing the average response to these five items. Social science researchers use this summated scale strategy to enhance the reliability of measures. Such a summation is reasonable only if the items are unidimensional in a factor-analytic sense and are internally consistent. Evidence of unidimensionality is provided by extracting all the principal components in these data. The results showed that only the first principal component had an eigenvalue greater than one, which indicates that one factor adequately describes the variance in the items. Evidence of internal consistency was provided by computing Cronbach's alpha, and this estimate (0.73) is well above the suggested 0.6 cutoff for basic research.[6]

4.8. Behavioral Uncertainty

The second aspect of uncertainty addressed here is the difficulty of assessing performance. We measure this variable by capitalizing on the notion that it is more difficult to ascertain adherence to contractual agreements by downstream actors when critical points in the selling cycle are separated by relatively longer periods of time. When transactions are performed instantaneously, the performance of each party is more readily observable. If the

6. See Churchill for a discussion of these issues related to summated scales. The appendix describes an alternative measurement model for this scale. The substantive results were robust across these procedures.

market reacts with a lag to actions taken, however, it becomes more difficult to attribute output to efforts. Each survey respondent answered the following question:

What is the typical time between an initial contact concerning the product and the ultimate placement of an order? _____months.

This measure (BEHUNCT) measures the length of the selling cycle and indexes the difficulty of assessing downstream performance.

4.9 Scale Variables

There are two scale variables included in the study. In the first of these, we asked the informant to report the sales volume of the product line in question (SALES).

What is the annual sales volume of this product line? $_____

The second scale variable described the density of sales territories. The density of a sales territory refers to the geographic concentration of customers. Denser territories make it possible to assign a company employee to that territory and to use that person's time efficiently. In relatively sparser territories, it may not be possible to exhaust the available time of company personnel assigned to that area. By contrast, independent resellers are better able to exhaust scale economies by aggregating the products of different firms. We measure territory sparseness as follows:

What percent of the typical field salesperson's time is spent on the following activities?
_____ face-to-face selling
_____ service, after sales support
_____ paper work
_____ travel time
_____ other
100%

Our measure of (lack of) density (SPARSE) is the fraction of time reported for travel. Obviously, more time is spent on the road when the density of the territory is lower. This is the same indicator of density used by Anderson.

5. RESULTS

The first model estimated from the data is a multiple regression model with the fraction of sales made through the direct channel (% DIRECT) as the dependent variable. The results are displayed in table 2. Since all the propositions specify the expected sign of the coefficient,[7] their significance is tested via 1-tail tests at the usual 0.05 level.

7. The dependent variable was first transformed using a logistic function, $ln\left[\frac{P}{1-p}\right]$, in order to constrain the range of predictions to lie between 0 and 100 on the original scale.

Table 2. Regression Model of Channel Configuration

Dependent variable: LN $\frac{\%\ \text{DIRECT}}{(1 - \%\ \text{DIRECT})}$		
Independent Variable	Coefficient	T-value
Constant	−1.061	0.203
SPSKILLS	0.147	2.608*
ENVUNCT	0.773	1.806*
BEHUNCT	0.218	3.001*
LNSALES	−0.057	−0.204
SPARSE	−0.059	−1.988*

R^2adj = 0.281.

*sig. at $p \leq .05$ (1-tail).

The model explains about 28 percent of the variation in sales volume through the direct channel. As the F-ratio indicates, this is a significant amount of explained variance. Turning to the individual coefficients, we see that specific assets (SPSKILLS) increase significantly the fraction of sales made directly to end-users ($b = 0.147$, $t = 2.608$). This result lends support for Proposition 1.

Regarding the uncertainty variables involved in Propositions 2 and 3, we see that the environmental uncertainty coefficient (ENVUNCT) is significant in the direction posited in Proposition 2 ($b = 0.773$, $t = 1.806$). The behavioral uncertainty coefficient (BEHUNCT) exhibits a similar result ($b = 0.218$, $t = 3.001$), which supports Proposition 3.

The final set of independent variables are the scale effects variables. Sales volume (LNSALES) has no significant effect on the dependent variable ($b = -0.057$, $t = -0.204$). The other scale variable (SPARSE) indicates that sparser territories are related to significantly lower levels of direct channel sales ($b = -0.059$, $t = -1.988$). Thus, only mixed support is found for Proposition 4.

Sales volume excepted, the above results appear to provide considerable support for the TCA predictions. It is quite possible, however, that the linear model does not describe the organizational decision very well. Suppose these channel decisions were made in a relatively "lumpy" fashion where the firm chooses a direct, indirect, or mixed channel. The continuous dependent variable would not capture such a decision very well. Since the theoretical model is not sufficiently refined as to permit us to exclude either possibility, it would seem necessary to verify the robustness of the results. To achieve this, we estimated another model with these data. This consisted of a maximum-likelihood estimation of a multinomial logit model. The independent variables remain the same, while the dependent variable is respecified as a qualitative measure to represent the (possibly) discrete decision.

We placed the firms in the sample into three classifications; direct, mixed, and indirect channels based on a 90 percent rule. If a firm sold more than

90 percent of its volume through either a direct or an indirect channel, we classified that firm into the direct and indirect channel categories respectively. The remaining firms were classified into the mixed channel category. The 90 percent cutoff was established by inspecting the distribution of the dependent variable for natural breaks. This is the same classification rule used by Lilien.

This classification yielded 15 firms in the indirect channel category (17 percent), 39 firms in the mixed channel category (44 percent), and 33 firms in the direct channel category (38 percent). The following multinomial logit model describing the probability that a firm will fall into the i^{th} category was estimated:

$$Prob\ (i/\tilde{x}) = \frac{e^{\tilde{x}\phi_i}}{\sum_{j=1}^{3} e^{\tilde{x}\phi_j}}$$

where $\tilde{x}$ is the vector of independent variables describing each firm and ϕ_i is the vector of coefficients associated with the i_{th} category.

Note that there is a set of ϕ_i coefficients associated with each category. Since these coefficients are determined only up to an arbitrary normalization, we have chosen the normalization $\phi_3 = 0$, where $i = 3$ describes the indirect channel. Each set of coefficients can now be interpreted as the effect of the independent variables on the probability of choice of that channel category relative to our chosen reference option (that is, the indirect category).

Table 3 displays the results of a maximum-likelihood estimation of this model. The Chi-square statistic displayed tests the hypothesis that the estimated coefficients (except the constant) are all zero. This is rejected at the 0.05 level.

Examining the significance of the ϕ_1 coefficients, we can see that SPSKILLS is significantly positive ($\phi = 0.187$, $t = 1.56$). Thus, as specific asset levels increase, the probability of using the direct channel increases relative to the probability of using the indirect channel. The environmental uncertainty measure displays a similar effect ($\phi = 1.66$, $t = 2.39$). The behavioral uncertainty measure is also significant in the expected directioin ($\phi = 0.553$, $t = 1.92$).

Turning to the scale-related variables, we see that sales (LNSALES) has no significant effect ($\phi = -0.011$, $t = -0.029$). Territory sparseness displays the anticipated significant negative coefficient, though ($\phi = -0.082$, $t = -1.78$).

As for the ϕ_2 coefficients, which assess the probability of the mixed channel category versus the indirect category, the specific assets coefficient is insignificant ($\phi = 0.097$, $t = 0.82$). The environmental uncertainty measure displays an expected positive coefficient, which is also significant ($\phi = 1.17$, $t = 1.80$). Similarly, the behavioral uncertainty measure displays a signifi-

Table 3. Multinomial Logit Model of Channel Configuration

Dependent variable: Direct, mixed, indirect channels
Reference category: indirect channel

Parameter ($\phi_{i=1}$)	Estimate	T-value
Constant	−4.446	−0.620
SPSKILLS	0.187	1.562*
ENVUNCT	1.660	2.394*
BEHUNCT	0.553	1.922*
LNSALES	−0.011	−0.029
SPARSE	−0.082	−1.781*
Parameter ($\phi_{i=2}$)		
Constant	−6.904	−1.062
SPSKILLS	−0.097	0.820
ENVUNCT	1.167	1.799*
BEHUNCT	0.480	1.686*
LNSALES	0.274	0.809
SPARSE	−0.075	−1.771*

Chi-Square (10 d.f.) = 31.64.

*sig. at $p \leq .05$ (1-tail).

Table 4. Independent Variable Derivatives

Variable	Direct	Mixed	Indirect
Constant	0.506	−0.688	0.182
SPSKILLS	0.023	−0.019	−0.004
ENVUNCT	0.137	−0.093	−0.043
BEHUNCT	0.024	−0.008	−0.016
LNSALES	−0.066	0.071	−0.005
SPARSE	−0.003	0.0003	0.002

cant, positive coefficient ($\phi = 0.48$, $t = 1.69$). The scale variable describing sales volume is insignificant ($\phi = 0.274$, $t = 0.81$), but the territory sparseness measure displays the expected significant negative effect ($\phi = -0.075$, $t = -1.77$).

The substantive results implied by these coefficients are more readily interpreted by examining the estimates in table 4. These estimates are derivatives that show how a change in any of the independent variables would affect the distribution of channel choices. Looking at the results of SPSKILLS, we see that as specific assets increase, the probability of the direct channel increases ($d_1 = 0.023$), while the probability of the mixed channel option decreases ($d_2 = -0.019$) as does the probability of the indirect channel ($d_3 = -0.043$). With respect to environmental uncertainty, increases in this variable result in more direct channels ($d_1 = 0.136$), fewer mixed channels ($d_2 = -0.093$), and fewer indirect channels ($d_3 = -0.043$). Behavioral uncertainty displays a similar pattern of results ($d_1 = 0.024$, $d_2 = -0.008$, $d_3 = -0.016$).

Turning to the scale variable, we find that larger volumes decrease direct

channels ($d_1 = -0.066$), increase mixed channels ($d_2 = 0.071$), and decrease indirect channels ($d_3 = -0.004$). These effects are not statistically significant, though. With respect to territory density, we see that increased sparseness decreases direct channels ($d_1 = -0.0028$) but increases mixed channels ($d_2 = 0.003$) and indirect channels ($d_3 = -0.002$).

Taken together, the results of the two models are remarkably consistent. They increase our confidence in the robustness of the effects found in the data. Specific assets and uncertainty consistently increased the use of direct channels. As for the scale variables, territory sparseness consistently decreased direct channel use, while the sales volume measure had no effect in either model.

6. DISCUSSION

To the best of our knowledge, this is the first empirical test of TCA predictions involving forward integration into distribution. Aside from Anderson's study of manufacturers' agents versus employee sales forces, no other empirical results concerning downstream integration have been reported. The results obtained here are supportive of the basic refutable predictions made form the TCA perspective. We saw that firms were less likely to use reseller channels when specific assets levels were higher. Similar shifts were observed for higher levels of environmental uncertainty and behavioral uncertainty.

Our study has several methodological and theoretical implications. From a methodological standpoint, it is the first study that has accounted for the possibility that firms do not use a single means of reaching the end-user. Integration is a matter of degree rather than a binary choice. Along these lines, Stinchcombe has argued persuasively that the continuous nature of these shifts should not be underestimated. In fact, his analysis would suggest an even more microanalytic approach with explicit measures of the actual hierarchical mechanisms involved.

The design of an empirical test of TCA predictions rests on developing sufficient information about the institutional forms present in the context of interest. It would appear that empirical studies of TCA propositions are best conducted at a semi-microanalytic level of detail. Accounting data are probably unlikely to suit the needs of such research. Rather, researchers will have to rely on the organizational and sociological tradition of using questionnaires and rating scale data. Large sample sizes and "representative" selection have to be sacrificed in order to obtain the requisite detailed information. Consequently, it becomes important to cumulate results across a series of smaller studies.

From the standpoint of theory development, we have already noted that the basic refutable propositions of the TCA approach are supported in this study. Nevertheless, the causal mechanisms underlying these results still await direct testing. For instance, it is presumed that the firm's response to

environmental uncertainty is prompted by the desire to make decision adaptively and sequentially. No direct evidence of this mechanism is currently available in the literature. Similarly, the effects of specific assets on the integration decision is presumed to be a reaction to the firm's vulnerability to opportunism. If, however, an exchange were governed by a norm of nonopportunism, then the model would become much more complex. Integration would presumably be a response only if the normative restraint were inadequate. Such an extension of the basic model rests on uncovering the conditions governing the appearance and maintenance of such normative restraints on opportunism.

Finally, with respect to the variables relating to the production cost, the present results contrast with the only other previous study that included production costs (Walker and Weber). They concluded that "comparative production costs" were responsible for most of the explanatory power of their model. Further, transaction costs variables received only "mixed" support in their study.

By contrast, the transaction cost variables were responsible for most of the explanatory power of the current models. Only one of the two production cost variables proved significant. One reason for insignificant results involving the sales volume measure of scale may be due to variance in the minimum efficient scale (MES) of distribution-related activities across the industries represented in our sample. Since we do not have a measure of minimum efficient scale to adjust the sales variable, our measure must be viewed with some skepticism. This possibility appears even more likely when one considers the significant supportive results obtained with the other scale variable. Unlike sales volume, the territory sparseness measure is not affected by interindustry differences in efficient scale. Time spent traveling is always an unproductive use of resources. On balance, it appears that both production and transaction costs are implicated in firms' decisions to integrate into the downstream channel. Nevertheless, the differences in results between the two studies suggest that further attention needs to be directed to the role of production costs in TCA models.

APPENDIX

Computing an average rating for five items described in section 4.7 to form the ENVUNCT measure assumes that these data are scaled intervally. Although this assumption has been used in the previous empirical studies of TCA propositions involving questionnaire data (Anderson and Schmittlien; Walker and Weber) and is standard practice in many disciplines, it is sometimes argued that rating scales provide only rank-order data. In order to assess the robustness of our results with respect to this assumption, an alternative measurement model was fitted and the vertical integration models

were reestimated. This alternative was the Rasch latent trait model described by Wright and Stone.

Rather than assuming that the observed responses are intervally scaled, the Rasch model assumes that the probability of a response to a rating scale item i is a function of the amount of the trait β_j presents in the subject j and a parameter δ_i that indexes the amount of the trait reflected in the item.

Specifically,

$$Prob[x_{ji} = 1 \mid \beta_j, \delta_i] = exp(\beta_j - \delta_i)/[1 + exp(\beta_j - \delta_i)]$$

where $x_{ji} = 1$ when subject j responds favorably, and
0 when subject j responds unfavorably to item i.

Using a maximum-likelihood estimator (Wilkinson), one can obtain estimates of the amount of the trait present in each subject from the observed responses of all the subjects to all the items. These estimates of the trait are scaled intervally although the observed data are only categorical.

To apply this model to our data, we first dichotomize the responses to each of the five items. Responses above the midpoint on the scale were given the value 1 while responses below the midpoint were coded as 0. These represent the high and low uncertainty categories of responses. Then maximum likelihood estimates of the latent trait being measured were obtained for each subject. The resulting intervally scaled estimate of the trait for each subject β_j was used in place of the previously used measure (ENVUNCT) in the regression and multinomial logit models.

These reestimated models show no substantive differences compared to the originally estimated models shown in tables 2 and 3. All previously significant variables remain significant and retain their sign. Likewise, all previously insignificant variables remain insignificant. Thus, it appears that our assumption of interval data arising from the rating scale items does not affect the conclusions drawn from the study.

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