

The Moderating Influence of Product Differentiation

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Abstract

Using a model based on transaction cost economic theory, the capability-based view and industrial organization, this paper explains why vertical boundaries of firms. By identifying transaction-, firm- and industry-level determinants and some interactions among them, we derive testable predictions about the choice of vertical integration. To test these predictions we analyze data from a sample of 187 firms in the DOC Rioja wine industry. As predicted, our results suggest that for studying the effect of concentration, it is fruitful to view the product differentiation as a moderating effect. In general, empirical evidence indicates that firms vertically integrate to mitigate opportunism, to deal with unforeseen contingencies, to internally exploit their capabilities and to increase market power in differentiated products.

Introduction

The organization field is fundamentally concerned with explaining differential firm's boundaries, which represents a question of great strategic importance for its managers [1]. Indeed, understanding why some firms produce a good or service themselves while others procure it from another organization is perhaps the central question in organization.

A large number of explanations for the “make” or “buy” decision have been offered. Although previous authors have tended to emphasize one point of view, it seems likely that most of the above explanations are in fact supplementary rather than exclusive [exceptions include 2, 1]. The present paper develops a more general framework and then uses it to test different aspects in a single model. Like Díez-Vidal [1], our conjecture is that vertical integration may be induced by market imperfections, transaction costs and other firm-specific resources. Hence, all must be jointly considered in explaining vertical integration. Unlike this study, which does not consider how they influence each other, we examine some interactions among approaches. In doing so, the paper mainly contributes to the existing literature on vertical integration by analysing how the environmental uncertainty influences the effect of experience on vertical boundaries in the wine industry.

We analyse Rioja Qualified Designation of Origin (DOCa) wine market, an industry with a wide variety of levels of vertical integration, and a significant degree of product differentiation. This industry was chosen because the “make” or “buy” decision will become more relevant if a proposal by the European Commission that consists on a liberalisation of planting rights in the EU wine market comes into force in 2018.

Developing the model and Hypotheses

There is no shortage of factors of the occurrence of vertical integration. Economic theory has shown that vertical integration may be induced by transaction costs, the development of strategic capabilities and market imperfections. All these determinants are jointly explored in our model.

Vertical integration and transaction costs

Research on transaction cost theory maintains that there are hazards associated with conducting certain kinds of transactions through the market, and that these kinds of transactions will therefore more efficiently performed within a firm. Therefore, we can advance that:

Hypothesis 1: The greater the potential transaction specificity of assets, the greater the likelihood of using vertical integration, *ceteris paribus*.

The earlier model developed by Williamson [3] proposed other three important factors that also drive integration decisions, namely transaction frequency, uncertainty, and small number bargaining.

According to Williamson [3], transactions characterized by small numbers bargaining are also hazardous because such transactions are more subject to haggling, delay, and other strategic behaviour by the parties when contractual disturbances arise. Accordingly, the small numbers bargaining hypothesis is the following:

Hypothesis 2: The smaller number of suppliers in the upstream market, the greater the likelihood of vertical integration by downstream producers, *ceteris paribus*.

A basic assumption of transaction cost theory is that all transactions are conducted under a certain level of imperfect information, which can impact exchanges.

Environmental uncertainty appears when the circumstances surrounding the exchange cannot be specified in advance. This complicates writing contracts since parties will have to devote a lot of time trying to identify the diverse contingencies that may arise. Nevertheless, although transactions will be completed less smoothly than in more certain environments, the market mode is still advantageous. Hence, unpredictability per se does not favour vertical integration, only in interaction with asset specificity [4, 5]. The following hypothesis can therefore be proposed:

Hypothesis 3: The greater the environmental uncertainty, in the presence of asset specificity, the greater the likelihood of using vertical integration, *ceteris paribus*.

A second form of uncertainty, which is linked to difficulty of evaluating performance, is recognized in Williamson's later writings [6] as "internal" uncertainty. Contracting parties should be able to evaluate the service or product being exchanged. If performance cannot be easily assessed, the market will fail because what to reward and how is not known [6]. Based on this reasoning, we hypothesize that increased internal uncertainty in the transaction will lead to an increased use of vertical integration.

Hypothesis 4: The greater the internal uncertainty, the greater the likelihood of using vertical integration, *ceteris paribus*.

Besides specificity and uncertainty, Williamson [6] agrees that other factors are also bound to operate in a given setting. In particular, Williamson points to diseconomies of scale as a factor limiting the extent of vertical integration:

Hypothesis 5: The larger the firm, the less likely it is that, *ceteris paribus*, the "vertical integration" governance structure will be chosen.

Vertical integration and firm capabilities

Barney [7] suggests that integration decisions are jointly determined by the expected cost of opportunism associated with accessing a factor through the marketplace as well as the expected cost of creating that factor inside the firm. Hence, a firm that owns innovation and marketing skills, which are valuable and difficult-to-imitate capabilities due to their intangible nature, will be more likely to integrate than its competitors. Therefore, we hypothesize:

Hypothesis 6: Marketing-intensive firms are more likely to choose integration for their transactions.

Hypothesis 7: Innovation-intensive firms are more likely to choose integration for their transactions.

With the constant pressure to meet consumer demands and the need to be competitive, firms must continually acquire, develop and upgrade their resources and capabilities [8]. Hence, the identification of the origin of strategic resources and capabilities (those that establish and enhance the firm's sustainable competitive advantage) represents one of the most complex challenges facing a firm. Although some authors ascribe capabilities to luck [9], resources and capabilities are traditionally considered as the product of a history of specific routines developed experientially at the firm. They are said to develop cumulatively, as firms learn to perform routines over time. As a result, some authors hypothesize that a firm with production experience will be more likely to integrate because it provides learning opportunities that enhance its production capabilities[2].

Other authors, however, emphasize that the effect of activity experience, or lack thereof, is more important when the environment changes quickly since, in such situations, a fast-changing environment not only demand greater firm's capabilities and needs important new knowledge but it also makes a firm's existing stock of knowledge through past acquired experience less effective. Moreover, the firm faces tighter temporal constraints and, since existing routines tend to prevent the pace and effectiveness of learning, it is unable to develop the necessary expertise in a timely and cost-effective way [10]. Then,

Hypothesis 8: The higher the joint impact of environmental uncertainty and firm's experience in the particular activity, the larger the likelihood of vertical integration into production.

Vertical integration and market power

Within the strategy literature, power market is generally defined as the ability to alter profitably price away from competitive levels for a sustained period of time. Where there is market concentration, there is some degree of market power, indicating the ability of a few firms in to influence the terms of trade and negatively impact market performance [11]. However, market power does not require monopoly or oligopoly power over a full market, but requires consumers to perceive that there are no exact substitutes for the product or service, or that such substitutes are in short supply [12]. Thus, if a firm serves a variety of product-markets, its market power could vary significantly across them depending on its degree of product differentiation.

The industrial organization literature identifies two main factors as influencing market power changes: the firm's market position, normally reflected by its market share, and the level of product differentiation [13]. It is argued that a firm with low differentiation cannot exercise much market power because their consumers are very price responsive [12]. That is, processors cannot raise prices for above costs without significantly reducing sales in markets with low differentiation because consumers can easily consume a substitute instead. Then, we establish that a firm's level of product differentiation moderates the effect of concentration on vertical integration as follows,

Hypothesis 9: The concentration factor will be more strongly related to vertical integration when firms possess high differentiation product than when they have low differentiation product in a product-market.

Empirical analysis

The decision to vertically integrate has attracted much attention recently in the Rioja wine grape industry due to a proposal made by the European Commission, which consists on a liberalisation of planting rights in the EU wine market by 2018.

In 1991, Rioja became Spain's first Denominación de Origen Calificada (DOC), a status which confirms that the wines of Rioja are among the world's finest. Nowadays, this region accounts for well over 20% of all Spanish wine sales and is highly regarded by consumers at home and abroad. In particular, Rioja wines can be found in the Top 100 wines of 2007.

Sampling and data collection

In this study, our aim is to examine the motives for vertical integration in the Rioja Designation of Origin wine industry. The survey was returned by 187 participants, 88.2 per cent of the population.

Variable operationalisation

A total of eleven determinant variables were operationalised for the current investigation. These measures were grouped in the three sets identified from the literature. Transactional attributes, capabilities and market power formed the three sets. We describe each of the eleven measures, by set, below.

(i) Measures for transaction attributes

For this set of determinant variables, we operationalised measures of specific assets, small numbers, uncertainty and size.

We use items on seven-point scales anchored by "strongly disagree" and "strongly agree" to measure some transaction cost dimensions, specificity and uncertainty. The constructs were operationalised with a mix of original and adapted items relied on previous survey-based transaction cost studies.

Specific assets (Hypothesis 1): The degree of specificity can be measured by the difference between the cost of the asset and the value of its second best use [5]. Asset specificity can take several forms: physical asset specificity, human asset specificity, site specificity, dedicated assets, temporal specificity and brand name capital. For the purpose of this study, we focus on physical asset specificity and dedicated assets. Physical asset specificity describes the situation where physical assets are tailored to a specific relationship and are difficult to re-deploy for other purposes without sacrificing productive value. Two complementary measures of asset specificity were developed. The first measure is the degree of downstream physical asset specificity, which measures the level of total fixed investment made by the processor. A second measure, the degree of upstream physical asset specificity, asked about the fixed investments made by the primary producer.

Dedicated asset specificity refers to assets which are assigned for the purpose of the current transaction only and would result in significant excess capacity if the transaction terminated prematurely [14]. Less attention has been paid to this type of specificity than to physical asset specificity.

Applied to our study, dedicated asset specificity refers to grapes which were grown for one particular vintner. As wine grapes are extremely perishable, the vintner could seek to appropriate rents by taking advantage of the grower's need to harvest and sell his grapes in a relatively short period of time. Given this definition, dedicated asset

specificity was operationalised as the excess capacity that a primary producer has to support if the grapes which were grown for a particular winery are rejected by it.

All measures of transaction-specific assets are developed and scaled such that higher scores imply higher degree of specificity in the transaction.

Small numbers (Hypothesis 2). To test for the effect of small numbers on the probability of vertical integration, the number of existing (or available) suppliers in a given period of time has been used traditionally as a measure of small number bargaining problems in previous literature [e.g., 2]. Then, in order to limit the influence of the year analyzed, we used one item that asked each processor how many growers on average would be willing to contract with him.

Environmental uncertainty (Hypothesis 3). Following to Williamson [3], we highlight one type of environmental uncertainty, that of environmental unpredictability. In our activity of analysis, the high level of dependency of viticulture to exogenous conditions such as hazardous and risky natural environment (drought, pests, flooding, insect infestations, disease, etc) is one of the main reasons of environmental unpredictability. The scaling of this concept is based on one item that indicates respondents' perception of environmental volatility.

As we mentioned earlier, the presumption of market superiority is undisturbed unless assets are specific to a nontrivial degree [4]. Following Coles and Hesterly [15], this condition was operationalised by means of an interaction between a dummy variable (λ) and environmental uncertainty. This dummy variable takes a value of 1 if the value of all items of specificity is above 1 (the minimal value of the scale), and 0 for values of 1.

Internal uncertainty (Hypothesis 4). Difficulty of evaluating performance is referred to as behavioral uncertainty [16, 17]. It may occur in the viticulture activity for two reasons. First, it is difficult to assess objectively the grape quality. Second, responsibility for vineyard production may not be assignable to an individual grower when a team of growers have worked the same vineyard. One question adapted from Anderson and Schmittlein [16] addressed the perceived difficulty of measuring the results of individual growers equitably.

Size (Hypothesis 5). Since variables based on assets are directly dependent upon the decision to integrate production activities, we use the logarithm of average capacity over the 2002-2004 period as a proxy of size [2].

(ii) Measures for firm-level capabilities

Marketing intensity (Hypothesis 6). The relationship between advertising and promotional expenditures and marketing communication have been found in the work of Balasubramanian & Kumar [18]. Similarly to these empirical works, we use the ratio of advertising and promotional expenditures to sales as a proxy for marketing communication intensity.

Innovation intensity (Hypothesis 7). Research and development expenditures are used as a proxy for innovation capability in a large number of studies in the economics literature. Therefore, an appropriate indicator of a firm's innovation capability is the intensity of its spending on research and development (measured by research and development expenditures to sales).

Experience (Hypothesis 8). This variable refers to the extent to which a firm has skills and capabilities for producing the good and an understanding of the underlying technology. Following prior empirical studies [e.g., 19], we measure experience as the number of years of experience in the wine-making activity.

Despite the growing popularity of experience analysis, there are some considerations to its successful application in explaining vertical integration. As we

mentioned earlier, the effect of experience is relatively meaningless without considering the pace of change in the environment [20]. The reasoning is that the relevant expertise can always be built up gradually over time in a manner compatible with the firm's resources and compatibilities. Hence, it is expected that the lack of relevant experience does not matter too much in a stable environment. To measure the experience effect we use the product of environmental uncertainty and the number of years of experience.

(iii) Measure for the market power

Firm's market position and product differentiation (Hypothesis 1). Market power refers to the ability of a firm within a market to profitably charge prices above the competitive level for a sustained period of time. A natural measure of market power is the price-cost margin mark up, often referred to as the Lerner index, since the price is equal to the marginal cost at a perfectly competitive market [21]. However, we are unable to measure price-cost margins because costs are private information which has not been accessible to us. Consequently, we must rely on some other indicator to measure the degree of market power. Market share information is another important gauge of the competition in the market [22]. We measure the market share for each firm dividing the sales of each firm by total sales.

In order to examine the moderator effect of product differentiation on market share, we divide Rioja wines into four categories according to the classification provided by the Regulatory Board of DOC Rioja, which are ordered by value added. Following this classification, we calculate market shares of each firm for each type of product. The variables are referenced by appending a subscript (the name of the category) behind the name "Market share".

Dependent variable and methodology

In order to measure the dependent variable, the degree of vertical integration between two stages in the production process, respondents (wine-making processors) were directly requested to indicate the percentage of inputs (grapes) used that is internally provided. A tobit analysis was conducted to statistically relate the survey items to the vertical integration decision. This model is preferred over OLS regression, since the dependent variable is censored in the range (0% to 100% of vertical integration).

Results and discussion

Table IA gives the coefficient estimates and goodness of fit measures for the nine hypothesized determinants of vertical integration with the Tobit technique. An important issue in a model is its stability. To test for this, different models were estimated across various specifications.

The robustness of the estimated coefficients across model specifications suggests that transaction characteristics as well as capabilities influence firms' vertical integration decisions in the wine industry (Models 1A to 2A). It is shown in the likelihood ratio test statistics of each model compared with those of its predecessor, which are all significantly different from zero.

Our results provide strong support for most of the hypotheses derived from transaction-cost analysis. According to hypothesis 2, transaction specificity of assets leads to integration. It has been largely corroborated with the parameters of upstream specificity of physical assets and dedicated assets. Conversely, the downstream specificity of physical assets is nearly insignificant. Contrary to our expectations, the results fail to support the existence of a significant direct effect between small numbers and integration (hypothesis 3). Hypothesis 4 is confirmed, so environmental uncertainty

is positively related to vertical integration in presence of a non-trivial degree of asset specificity. We find weak support for the hypothesis 5 that with measurement problems transactions are more likely to be integrated.

The findings in this paper are generally consistent with the predictions of the resource and capability-based view. We found strong evidence that innovation intensity affects vertical integration. In contrast to this consistency with marketing intensity, our evidence fails to support the innovation intensity hypothesis. As anticipated in hypothesis 9, the combination of experience and environmental uncertainty is significantly associated with vertical integration.

Consistent with industrial organization literature, hypothesis 9 predicted that product differentiation would moderate the effect of concentration on vertical integration. In particular, it was argued that the likelihood of market failure was most severe in exchanges that exhibited both high degrees of concentration and product differentiation. Our results in models 3A and 4A provide support for this hypothesis. First, the variable concentration individually does not affect significantly to vertical integration (see model 3A: the coefficient associated with market share is not significant and the model fit does not improve by including it). Second, the results presented in model 4A support the existence of a significant direct effect between market share with high differentiation and integration and suggest an insignificant negative effect between market share with low differentiation and integration. In this way, the coefficient on $MARKET\ SHARE_{GRANRESERVA}$ is positive and highly significant, while the rest of coefficients related to market share remain insignificant.

<i>Variables</i>	<i>Part A. Tobit model</i>			
	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
Downstream physical specific assets	3.266	3.217*	3.147*	2.154
Upstream physical specific assets	6.741***	5.617***	5.677***	6.147***
Dedicated specific assets	5.315***	5.935***	5.973***	6.675***
Small numbers	3.033	2.091	2.195	2.568
Environmental uncertainty interaction	10.296***	5.347**	5.248**	5.477**
Behavioral uncertainty	4.530**	3.622*	3.655*	3.159
Size	-11.351***	-12.543***	-13.458***	-14.534***
Marketing communication intensity		2.138**	2.070**	2.286**
Innovation intensity		2.899*	2.865*	1.631
Experience*Environ. Uncertainty		0.095***	0.095***	0.091***
Market share			1.149	
Market share _{GUARANTEE OF ORIGIN}				-1.937
Market share _{CRianza}				-2.540
Market share _{RESERVA}				-0.856
Market share _{GRAN RESERVA}				11.828***
Cragg-Uhler (Nagelkerke) R ²	0.423	0.515	0.516	0.550
Likelihood ratio Test	-603.294	-587.152	-586.995	-580.173
Chi-square statistic	0.000	0.000	0.000	0.000

^ψ N=187 for all models

Levels of significance: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Tobit model: Total N outliers (0 value, 100 value) 85 (28, 57) Parameter estimates for constants are omitted.

Our results provide evidence that the combination of industrial, transactional and firm-specific factors appears to offer a useful explanation of the firms' vertical integration decision in the wine-industry.

The incremental benefit from including each set of factors in the analysis can be evaluated with the statistical significance. In this way, transactional attributes are highly effective at explaining vertical integration decisions (Nagelkerke's $R^2 = 0.423$). Transactional attributes have a contribution to the vertical integration choice in different ways. Consistent with transaction cost analysis is the finding that the decision of vertical integration is reinforced as asset specificity increases: firms integrate to avoid problems of lock-in that may arise from large sunk investments. It is observed that upstream physical asset specificity and dedicated asset specificity present the appropriate sign and are statistically significant. However, downstream physical asset specificity has a much lower significant impact on the decision to integrate these transactions. The results fail, however, to support the small-number hypothesis, which is a less central prediction of the transaction cost model.

We also find support for Williamson's (1985) proposition that environmental uncertainty, in presence of a non-trivial degree of specificity, raises transaction costs appreciably. Thus, hypothesis 3 is supported. We also performed these analyses for the case where the dummy variable $\lambda = 1$ for the values of all items of specificity above 2, and 0 otherwise. The results of the empirical analyses were not substantially changed by altering the interaction variable in this way.

The results provide weaker support for hypothesis 4, that increased measurement problems in the transaction leads to an increased use of vertical integration.

Our estimated results found support for the transaction cost variable of size, consistent with previous empirical research. In accordance with transaction cost reasoning, the incentive for vertical integration is negated by strong diseconomies of scale, supporting that diseconomies of scale could be a factor limiting the extent of vertical integration.

In order to examine whether the internal pool of capabilities really add explanatory power to our model, Nagelkerke's R^2 was compared between the model 2 and the model 1. The observed increase in Nagelkerke's R^2 was 0.092 and demonstrates that firm-specific capabilities also increase the explanatory power of the model.

In DOC Rioja, many advertising messages suggest that wineries make their wines with grapes from their own vineyards, suggesting a guarantee of quality. Coherent with this fact, we obtained that advertising and promotional expenditures exhibit a strong positive relationship with vertical integration.

However, research and development expenditures are nearly insignificant, indicating lack of support for hypothesis 8. Similar to hypothesis 4, the discrepancies could be due to differences in the specific characteristics to the industry. Compared with producing many other primary products, grape growing is highly labour intensive, particularly for cultivation, pruning and harvesting. Then, the nature of this industry could explain the weak role of innovation in vertical integration decisions.

Hypothesis 9 relates to the interaction effect of experience and environmental uncertainty on vertical integration. This hypothesis is tested with the coefficient of the interaction term $\text{experience} * \text{environmental uncertainty}$. This coefficient is positive and significant, which demonstrates that environmental uncertainty strengthens the effect of experience on vertical integration as Madhok [20] proposed.

Market power alone appears to have no impact on the use of vertical integration, as the term does not contribute significantly to the fit of the model (see model III). Consistent with Borenstein *et al.* [12], we obtain that market share is positive and highly significant in the highest degree of product differentiation, being insignificant for the other categories analyzed (see model IV). This is an important finding that supports our hypothesis that the level of product differentiation moderates the effect of concentration on vertical integration. In table 2 we summarise the hypothesis formulated above and the results obtained.

Conclusions

Understanding the factors that determine which type of transactions are mediated through markets and within firms has been an important subject of theoretical and empirical work in the organization literature. Despite the considerable research on determinants of vertical integration, this study contributes to the literature in two important ways. First, our study sheds new light on the importance of analysing jointly the determinants related to market power, processor-producer relationship and capabilities for explaining vertical integration choice. In particular, the main findings indicate that all of them contribute to explain vertical boundaries. Our results also reinforce the importance of product differentiation in the effect of power market on vertical integration.

Several caveats about limitations deserve consideration. First, our study focused on vertical integration decisions in the wine industry. Thus, conclusions and inferences about the results may be limited to this setting and may not address vertical integration choice in other industries. However, we believe many of the factors that are associated with firm boundaries in the current study can be found in other settings, particularly in differentiated-product industries. Secondly, although we have analysed some interactions among theories, it could be interesting in future research to test other interactions. For instance, how the concentration influences on the investment in research and development.

In spite of these limitations, two considerations are worth mentioning here. First, as modelling the decisions of established firms can provide a useful benchmark for future decision-making [24], our findings may be of considerable value to managers faced with the complex task of selecting a governance mechanism for their production process. Our study also suggests that it may be appropriate to analyze more thoroughly the factors related to industrial structure, transaction costs and internal capabilities as well as their interactions to better understand determinants of firm boundaries in the context of economic theory.

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