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Determinants of Product Upgrading in the Argentine Wine Industry

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by

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Dedication

To Christine, for her love, patience and motivation, and to my parents, for their belief and persistence.

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Abstract

In this thesis, I examine the impact that a firm's connections and internal resources has on the firm's ability to develop new products. The capability to make improvements to products is crucial to the long term success and growth of a firm. By using structural equation modeling, I take a different approach to network analysis to analyze data from the Argentine wine industry. While I did not find strong evidence to support the hypothesis that the combination of external networks and internal knowledge are key drivers to product upgrading, there was strong evidence to support each individual determinant's impact on upgrading.

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Chapter 1: Introduction

The ability of a firm to upgrade its capabilities is essential to surviving in a competitive and evolving market place. There has been considerable research to date covering this topic, addressing it from its various perspectives, both internal and external (for a review, see McDermott and Corredoira, 2010). Little of this research, however, approaches the issue from a holistic perspective, accounting for how external and internal resources answer the question: How do firms acquire the capabilities they need to remain competitive?

Paramount to this question is the ability to gain and implement new knowledge. Knowledge transfer occurs through a variety of mechanisms, including personnel mobility, training, communication, observation, reverse engineering, research and external communications (Argote, Ingram, Levine and Moreland, 2000). Previous research has shown that employee mobility is a powerful means of knowledge transfer (Argote, Ingram, Levine and Moreland, 2000). These movements within and between firms create the potential for gains in regards to capability and resources (Zaheer and Bell, 2005; Corredoira and Rosenkopf, 2010). Yet there are challenges to collecting and incorporating this dynamic in a broader study of firm upgrading. In this thesis, I focus on firm level characteristics of external communication and organization composition in the production of wine. While this does not specifically address many issues that have been determined to result in upgrading, the overall firm composition will inform elements like training and communication.

This thesis will investigate the Argentine wine industry through a survey that covered 115 wineries during 2004-05. The survey provides data for many aspects of the wineries, including product upgrading, demographics, location, along with ties to firms, public support institutions and other organizations. By utilizing structural equation modeling, I show how these different characteristics interact with one another and their impact on product upgrading. This method is utilized to account for the various causation and correlation issues present when analyzing firm structure. The method accounts for the unobserved factors that are difficult to capture through survey data. Through this modeling approach, I attempt to show the importance of different connections dependent on the current position and structure of the firm.

Chapter 2: Background and Literature Review

Much has been written about the determinants of firm competitiveness in an increasingly global economy. Until recently, much of the focus has been on the internal firm structure and how firms develop new products and processes internally. For instance, Cohen and Klepper (1996) investigated the impact of firm size on the development of new process and products, and how changes in firm size create a natural shift from new product generation to new process generation due to new processes creating a larger return on investment for larger corporations. Szulanski (1996, 2000), focused on the impediments of knowledge transfer and capability upgrading, highlighting absorptive capacity of new information and motivation as two of the more consistent causes of internal stickiness.

Within this research program, a firm's ability to create knowledge has been a central concept, whether through education, management, process innovation or research and development. A strand of this research has looked at individuals as sources of capability upgrading, identifying key contributors and how they impact the capabilities of firms that acquire them by bringing new information and ideas (Corredoira and Rosenkopf, 2010).

An interesting finding in this research stream was uncovered by Corredoira and Rosenkopf (2010), who discovered that an individual has not only an impact on the firm it entered, but on the firm it left. The research showed that firms tended to gain capabilities from employees lost, likely due to the new connections gained through employees who still had strong personal ties to the original firm.

The transfer of information among firms has become the focus of recent investigations concerning capability upgrading. A prevailing vein of this research focuses on how networks provide an opportunity to create a competitive advantage at both the firm and individual levels. By finding network gaps between focal points, an entity can find a space in which it can act as a conduit of knowledge, and thereby gain experience as well provide an indispensible service to the focal points (Zaheer and Bell, 2005; Ahuja, 2000).

There have been additional studies concerning how information passes between firms and the conditions under which firms exchange information along with the factors that help cultivate symbiotic relationships. Dyer and Hatch (2006) conducted a detailed study of the U.S. automotive manufacturing industry and the impact having extensive lines of communication between buyers and suppliers had on the manufacturing process. They found that there were significant gains to efficiency and quality by fostering a more open relationship between buyers and suppliers.

In a similar line of research, McEvily and Marcus (2005) investigated the impact of information sharing, trust, and joint problem solving on the level of specific capabilities in the supplier/customer relationship. The research showed the direct and indirect effects that these network factors have on quality control and pollution prevention.

Another advance found in McEvily and Marcus (2005) is the use of structural equation modeling. Despite its widespread application in psychology and sociology to analyze survey data, this methodology has not been often used in firm network analysis.

One of the main advantages to structural equation modeling is the ability to specify variables that do not have a direct measure, known as latent variables. These variables are based on a series of directly measured variables that allow a researcher to capture data that would otherwise be hidden. In their paper, McEvily and Marcus (2005) utilized several survey response answers to construct the concepts of information sharing, trust, and joint problem solving.

Another line of research looks not at the quality of relationships, but at the quantity and diversity of those relationships. It has been shown that bringing new information into a firm is important for capability upgrading (McDermott, Corredoira and Kruse, 2009; McDermott and Corredoira, 2010). In their research, the authors illustrated that having ties to a geographically diverse set of firms has a positive impact on capability upgrading. Their research also focused on the positive impact of having connections to central nodes of firm networks as well as government institutions that provide a similar ability to aggregate diverse information. While aspects of the individual firms were included in these papers, they were utilized as controls to isolate the impact of the network.

This thesis bridges the gap between the two key features of capability upgrading: the internal resources and knowledge bases and external information and support structure. In doing so, I hope to illustrate the means by which firms can maximize potential relationships and further develop new products.

Chapter 3: Data and Methodology

The data used for the analysis in this study comes from a survey conducted in 2004-2005 on the Argentine wine industry. The survey was designed by McDermott and Corredoira and implemented in conjunction with a regional agricultural extension center (McDermott, Corredoira and Kruse, 2009). The database is cross-sectional. It comprises both wine industry firms and related entities with which firms interacted regarding specific strategic areas, such as product development, production methods, technology acquisition, marketing and exports (McDermott, Corredoira and Kruse, 2009). The survey was designed following several years of interviews conducted by McDermott and Corredoira between 2000 and 2003 in which they interviewed government officials and industry experts. In total, 115 firms were randomly selected from a roster of wineries in Mendoza and San Juan, Argentina. Of the 115, 15 refused to participate and were replaced with 15 similar, randomly selected firms. Including non-response and missing data, there was an 84% response rate. Responding firms were similar when compared with government sources on geographic distribution, age, size and foreign direct investment (McDermott, Corredoira and Kruse, 2009).

Section 3.1 Discussion of Dependent and Independent Variables

Dependent Variable

For the dependent variable used in this study, a measure of product upgrading within the firm, I utilized the outcome variable constructed by McDermott, Corredoira and Kruse from which the data originated (McDermott, Corredoira and Kruse, 2009). The authors used factor analysis with oblimin rotation (PROC FACOTR, SAS v.9) to construct the variable. The initial analysis included 22, five-point Likert scale questions covering elements such as: the regular introduction of new and higher value wines, emphasis of quality over cost, experimentation with new blends, varietals and clones, and monitoring domestic and overseas markets (McDermott, Corredoira and Kruse, 2009). Factor analysis resulted in eight responses loading on two factors being included with a Cronbach's alpha of 0.78. The responses to these questions were summed to create the dependent variable.

Explanatory Variables

The central idea behind this thesis is that product upgrading is affected by the ability to create new knowledge through research and development and the ability to interpret new knowledge through the firm's network of connections. I represent the external relationships by accounting for a firm's ties to different types of organizations. The source survey asked wineries to identify organizations in the following categories with which they regularly interacted, collaborated or exchanged information: firms (other wineries, grape growers, technology suppliers, consultants, etc.), associations, banks, cooperatives, schools and institutions (McDermott, Corredoira and Kruse, 2009). A firm's count of references to organizations in each of these categories was then tallied, allowing for multiple references to the same organization to be counted. In doing so, the strength of a relationship would be allowed to contribute to the overall impact of a firm's connection to an organization category.

A firm's ability to upgrade is dependent on the quality and relevance of the information available. By having connections to a geographic diversity of organizations, firms can improve their chances of coming across information that can be applied to their own situation. The positive impact of geographic diversity of ties has been shown to increase product upgrading within an industry (McDermott, Corredoira and Kruse, 2009, McDermott and Corredoira, 2010). To account for information diversity, the location of each firm reported as a connection was identified and classified into one of seven zones: North, South, East, San Juan, Valle de Uco, the rest of Argentina and international. An index was then created that was one minus the Herfindahl index of geographic concentration for each surveyed firm.

The ability of a firm to absorb new knowledge, either internally or through external connections is represented by two variables: education and enologist. Education is an index variable that sums the level of education of top management and enologists. Enologist is a count of enologists on staff, with part time hours allowed. Because records on research and development are not typically kept in the Argentine wine industry, these variables are a proxy for a firm's ability to absorb and create new knowledge. Upgrade motivation is a third factor from the factor analysis on the dependent variable that had loadings from questions that signaled intent to upgrade. This is used to control for a firm's desire to improve their products, without which the absorptive capacity would have little impact.

Control Variables

The diversity and quality of a firm's connections depends to a large extent on the geographic location of that firm. The inability to make connections with other organizations in what was, prior to the economic revival in Argentina during the 1990s, an isolated and even antagonistic environment (McDermott, Corredoira and Kruse, 2009), limits a firm's ability to learn from its connections and in many cases isolates them. To account for this natural barrier to firm connections, the surveyed firms were divided into five geographic regions with dummy variables representing each one. The five zones are: Norte, Sur, Este, San Juan, Valle de Uco, with Norte being omitted in the regressions.

Internal inertia is one of the factors that has been shown to impact upgrading (Szulanski, 1996). Inertia is affected by both the level of embeddedness of existing processes and of the end product. Especially for the later, the age of the firm is highly correlated with these factors, as best practices improve over time and brand identity becomes a concrete aspect for consumers. To account for this, the age of the firm is represented in years (McDermott, Corredoira and Kruse, 2009).

Upgrade capacity is also influenced by the availability of resources to implement changes. Whether through equipment, personnel or raw materials, implementing changes to products requires capital. To control for access to greater resources, a dummy variable was constructed for firms that had greater than 10% equity from foreign investment (McDermott, Corredoira and Kruse, 2009).

Competition is a factor that has a strong influence on a firm's actions. The need to compete in both quality and cost drives firms to make improvements to both products and processes. When firms engage in the international market, they introduce themselves to a larger volume of competitors and lose the advantages such as low transportation costs and the lack of duties that they may enjoy domestically. Because of this added competition, firms that export a larger share of goods internationally can be reasonably expected to be more innovative when it comes to their products and processes. As a control, the share of revenue from exported goods is used to represent a firm's exposure to international market pressures.

Firm size has been shown to impact a firm's capacity to upgrade (Cohen and Klepper, 1996). While larger firms typically have more access to resources and capital to invest in improvements and larger networks, they also experience greater levels of stickiness when it comes to implementing and transferring knowledge (Szulanski, 1996). Cohen and Klepper (1996) showed that larger firms tend to focus more on improvements in process, where the changes can impact the firm at multiple levels and can lead to gains across the organization and processes. Small firms, meanwhile, realize greatest gains to investment through the development of new products, as process upgrades are typically small in scale and impact a smaller number of individuals. To account for the different dynamics of firm size on product upgrading, a six-point scale of firm size in terms of revenue is included. This variable controls for the impact of resources and institutional advantage of the size of a firm.

A summary of all variables are provided in Table 3.2 with descriptive statistic and a correlation matrix presented in Table 3.2.

Table 3.1: Variable Definitions

Variable	Model Label	Definition
Product Upgrading	Upgrading	Added response to eight Likert scale questions on product upgrading
East Zone	Este	Dummy variable indicating location in this geographic zone of the Mendoza province (North Zone omitted)
San Juan Zone	San Juan	Dummy variable indicating location in the San Juan province
South Zone	Sur	Dummy variable indicating location in this geographic zone of the Mendoza province (North Zone omitted)
Valle de Uco Zone	Uco	Dummy variable indicating location in this geographic zone of the Mendoza province (North Zone omitted)
Age	Age	Age of the firm in years
Export Percentage	Export	Percentage of firm sales that come from exports
Information Diversity	Diversity	Herfindahl index that measures the geographic diversity of the associated firms
FDI Dummy	FDI	Dummy variable indicating at least 10% of equity from foreign investment
Total Sales	Sales	6-point categorical variable representing sales revenue
Ties to all except Firms and Institutions	Ties MFI	Count of mentions of non-firm, non-institution organizations, allowing for multiple mentions of the same organization
Ties to Firms	Ties Firms	Count of mentions of firm organizations, allowing for multiple mentions of the same organization
Ties to Institutions	Ties Insts	Count of mentions of institution organizations, allowing for multiple mentions of the same organization
Enologist	Enologist	A count of staff enologists, partial time is allowed
Education	Education	An index that sums the level of education of top management and enologists
Upgrade Motivation	Motivation	Commitment to activities and assets that promote upgrading as per responses to Likert scale questions

Table 3.2: Correlation Table and Descriptive Statistics

		VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR 10	VAR 11	VAR 12	VAR 13	VAR 14	VAR 15	VAR 16
VAR 1	Upgrading	1.00															
VAR 2	Este	-0.07	1.00														
VAR 3	San Juan	0.00	-0.33	1.00													
VAR 4	Sur	-0.20	-0.30	-0.21	1.00												
VAR 5	Uco	0.06	-0.28	-0.19	-0.18	1.00											
VAR 6	Age	-0.15	0.20	0.02	-0.09	-0.01	1.00										
VAR 7	Export	0.20	-0.19	-0.17	-0.07	0.06	-0.31	1.00									
VAR 8	Diversity	0.06	-0.42	0.03	0.18	0.34	-0.02	0.14	1.00								
VAR 9	FDI	0.23	-0.21	-0.15	-0.13	0.21	-0.13	0.51	0.06	1.00							
VAR 10	Sales	0.11	0.00	-0.16	0.17	-0.11	0.07	0.07	0.09	0.18	1.00						
VAR 11	Ties MFI	0.18	-0.28	-0.12	0.05	0.52	0.04	0.00	0.68	0.09	0.28	1.00					
VAR 12	Ties Firms	0.21	0.38	-0.34	-0.10	0.01	0.00	-0.16	-0.25	-0.06	0.30	0.23	1.00				
VAR 13	Ties Insts	0.15	-0.29	-0.25	-0.07	0.84	-0.08	0.69	0.52	0.14	0.01	0.17	0.09	1.00			
VAR 14	Enologist	0.18	0.06	-0.07	0.18	-0.07	0.09	0.03	0.06	0.09	0.32	0.06	0.14	-0.08	1.00		
VAR 15	Education	0.27	-0.19	-0.08	-0.10	0.39	-0.05	0.32	0.32	0.36	0.15	0.38	-0.01	0.44	0.16	1.00	
VAR 16	Motivation	0.38	-0.25	-0.06	-0.08	0.47	-0.09	0.33	0.35	0.25	0.14	0.41	-0.03	0.45	0.04	0.45	1.00
	Number of Observations	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93
	Mean	19.31	0.32	0.18	0.16	0.14	17.45	18.76	0.46	0.09	3.02	6.24	16.44	3.49	1.26	4.10	4.77
	Standard Deviation	7.04	0.47	0.39	0.37	0.35	19.12	27.97	0.23	0.28	1.85	6.98	10.03	5.18	0.83	2.46	3.20
	Min	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17
	Max	33.00	1.00	1.00	1.00	1.00	83.00	95.00	0.79	1.00	6.00	29.00	46.00	23.00	5.00	14.00	12.00

Figure 3.1: Map of Argentina Provinces

Source:
http://commons.wikimedia.org/wiki/File:Map_of_Argentina_with_provinces_names_es.png
Accessed:
11/10/2014

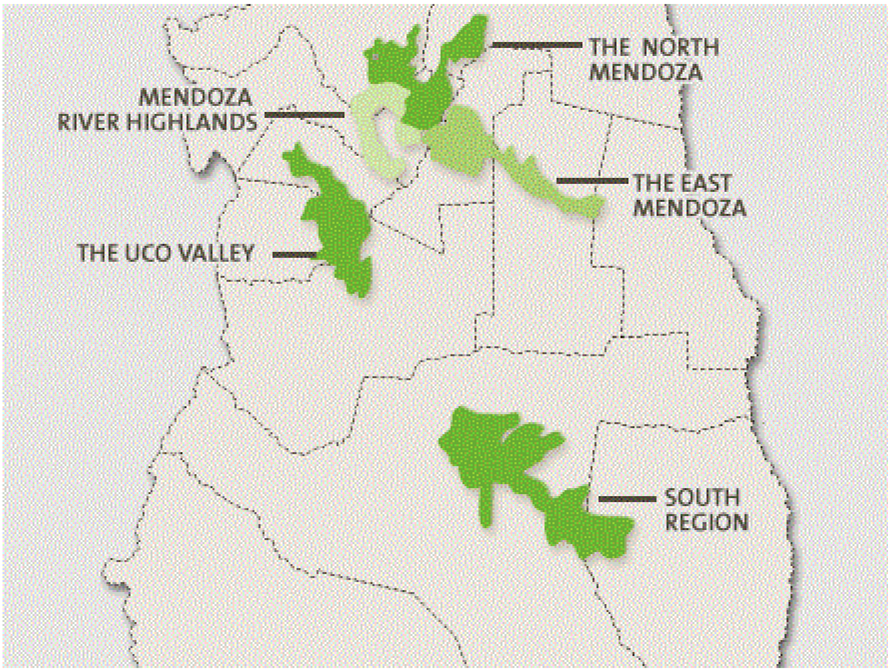


Figure 3.2: Map of Wine Growing Zones of Mendoza

Source:
http://www.aventurawine.com/wine-regions-mendoza
Accessed:
11/10/2014

Section 3.2 Methodology

Ideally, it would be possible to track the changing relationships and structure of a firm and conduct a longitudinal study on how those changing relationships affect the firm's ability to innovate. Because of the challenges of collecting that type of information, the instantaneous scenario became the focus of this research. This required the assumption that the nature of a firm's structure and relationships is slow to change, while product developments occur more quickly. While this notion is supported in research on innovation and knowledge transfer (Szulanski, 2000; Cohen and Klepper, 1996), it does bring the question of causality into the forefront. In a cross-sectional environment, does sales revenue give an indicator of capacity to develop new products, or is increased sales revenue a result of product innovation? A logical case could be made for either direction and the relationship is possibly cyclical. Potentially, an instrumental variable could be found that could explain product upgrading capacity without being dependent on the level of product upgrading. Past research has typically utilized research and development expenditures, but as such a variable is not available, other approaches needed to be considered.

An additional challenge to modeling product upgrading is multicollinearity. While correlations were low across many of the explanatory variables, the correlation matrix reveals moderate to high association among some explanatory variables, most importantly the network variables. The results of this correlation matrix appear logical. For instance, a high number of connections to institutions is strongly and positively correlated with associations, banks and cooperatives. As institutions are utilized as a means of filtering both information and networking, it makes sense that those with ties to institutions would have similarly large networks outside of them. Additionally, connections to organizations also appear to be related to regional location, with firms located in the San Juan region having negative correlation to all organization types and those in the Uco Valley having positive correlations.

Because of multicollinearity and non-recursive variables, along with a lack of viable data for the creation of instrumental variables, I chose to model product upgrading using structural equation modeling. Structural equation modeling allows for the use of latent variables, which can capture the effect of unmeasured variables of influence, which are likely to be present in survey data. Additionally, they provide the ability to create a multilevel model such that can reduce the level of correlation in the explanatory variables, reducing standard errors and improving the identification of significant factors.

To create the latent variable for the model, I first isolated a set of attributes that could be explained by the available variables. The attributes were: the ability to interpret information, absorptive capacity, and the availability of resources to implement product changes, resource capacity. Variables were then selected for the analysis as they related to the latent attribute. For absorptive capacity, I began with sales revenue as this would be a proxy for employee size and potential for employee knowledge, education level, and enologists on staff. These factors directly influence the ability to interpret new information. The dummy for foreign ownership represents potential access to invested knowledge resources. Motivation level is an estimate for the amount of energy expended in absorbing new information. Company age informs how willing a firm may be to change products. For resource capacity I included variables that would indicate the presence of financial capability to upgrade. Sales revenue was used as a proxy for available resources to invest into research and development, foreign ownership was used in the same vein. Ties to banks were also considered, as connections may indicate a positive ability to acquire new financing, though it may also indicate a firm that is carrying higher loan debts. Firm age was included as a measure of relative firm stability which may allow for further investment in product upgrading.

To evaluate the validity of the attributes, I employed confirmatory factor analysis using SEM in Stata 13 following the procedures outlined in Acock's *Discovering Structural Equation Modeling using Stata* (Acock, 2013). Factor analysis on the resource capacity variable resulted in no significant loadings. Initial results for the absorptive capacity variable showed that the firm's age and presence of enologists were not significant. As enologists seemed vital to interpreting new information on product upgrading, I decided to exclude firm age from the next iteration. The resulting loadings were all significant and positive. To confirm this result, I then used principal component factor analysis, which resulted in two factors that received significant loadings. As sales revenue was the only variable that loaded above 0.5 on both factors, it was removed and the process was repeated. The resulting set created a singular factor with all loadings significant using principal component factor analysis. The alpha value was low at 0.470 and had an insignificant loading of enologist when looking at the confirmatory factor analysis. To improve this loading, foreign ownership was dropped as this field was the hardest to justify logically of those included and had the lowest loading. The resulting trio of variables all loaded significantly with an alpha of 0.472.

Section 3.3 Models

This paper is built on previous research that analyzed the same data set. McDermott, Corredoira and Kruse (2009) looked in depth into how the ties a firm had with various organization types impacted the product upgrading decision of the surveyed firms. The authors showed that firms ties to other firms and institutions, in particular public-private institutions, did in fact have a positive impact on product upgrading. This thesis attempts to expand upon those findings by investigating how the different structural components and network of ties influence the effectiveness on their relationships in regards to product upgrading. The goal is to better understand how firms learn from their networks and where their efforts can best be exerted.

The initial objective is to develop an understanding of how the control and independent variables affect the dependent variable. McDermott, Corredoira and Kruse utilized least-trimmed squares regression to control for outliers in the small data set. The method of estimation I employ relies on maximum likelihood. The initial set of models begins with a simple version of previous specification, and explores the validity of the model in the context of the revised approach. Next, I identify a model that best fits the data.

The central proposition of this thesis is that a firm's network and ability to interpret information are paramount to their ability to upgrade products. As such, with more information from a greater multitude of ties to both firms and institutions, a firm would be more likely to upgrade. Additionally, without educated professionals in key places in a firm and a desire to make product improvements, a firm is less likely to upgrade products.

Hypothesis 1: The key determinants to product upgrading will be ties to firms, ties to institutions, and a firm's absorptive capacity.

Access to new information has been shown to be important to product innovation. But it stands to reason that there would be limits to the benefits of that information, either because it is inaccessible or because it is not distinct enough from what is already known. To that end, connections to a large number of organizations are only beneficial if there is sufficient diversity in the information being received. Ties to a large number of organizations that are providing similar information should only serve to overwhelm the winery with information. But with a diverse amount of available information, there is a greater difficulty in processing that information and turning it into a usable resource. Institutions designed to support firms should therefore play a role in improving the effectiveness in both informational quantity and diversity.

Hypothesis 2: Firms with more ties to institutions will realize greater returns to their relationships to and the geographic diversity of other firms.

The premise of this thesis is that ties to organizations provide firms with valuable knowledge that can be utilized to create new products, but that knowledge is only useful if the firm has the right tools to make use of it. A key component of this notion is the level of educational training within the organization. The hypothesis is that firms with higher levels of learning, whether that be in the form of enological learning or other forms of higher education, will be more able to interpret the information they receive and create new products (Szulanski, 1996, Argote and Ingram, 2000, and McDermott and Corredoira, 2010, Corredoira, 2009).

Hypothesis 3: Firms with strong absorptive capacity will realize greater benefit to their relationships to other firms and institutions and geographic diversity of information in the form of increased product upgrading.

Below are diagrams that illustrate the models from the above hypotheses. Not all models that are reported have been included, only those providing the best model fit for the hypothesis it is attempting to confirm. The diagrams are constructed according to standard convention of the display of structural equation models, with rectangular shapes indicating a measured variable and oval shapes indicating a latent, unmeasured variable. The structural part of the model is shown with arrows going towards the dependent variable, in this case the upgrading variable. Any variable with an arrow pointing to the dependent will be assigned a typical beta coefficient. Additionally, there are arrows pointing to some of the independent variables, enologist, education and motivation. This is the measurement portion of the model. These arrows flow from the latent variable, explaining the commonality among these three variables. There is still a need to account for the variance that is unexplained in the model. This variance is represented by the smaller circles. In a typical model, each measured variable that is predicted in the model receives an error term. To account for interaction terms, there are arrows that do not direct towards a measured variable, but towards another arrow. These arrows indicate an interaction between the variable the arrow originates from and the origin source it is pointed towards. For instance, in Model 9 there is an arrow pointing from Ties Insts towards the arrow coming from Ties Firms indicating the interaction between those two variables. Lastly, we come across two different estimation methods that are not represented graphically in the models. Models 7-11 in the diagrams use standard maximum likelihood estimation. In models 12-15 in the diagrams, generalized structural equation modeling is employed, which is the use of generalized linear modeling within the structure portion of the model.

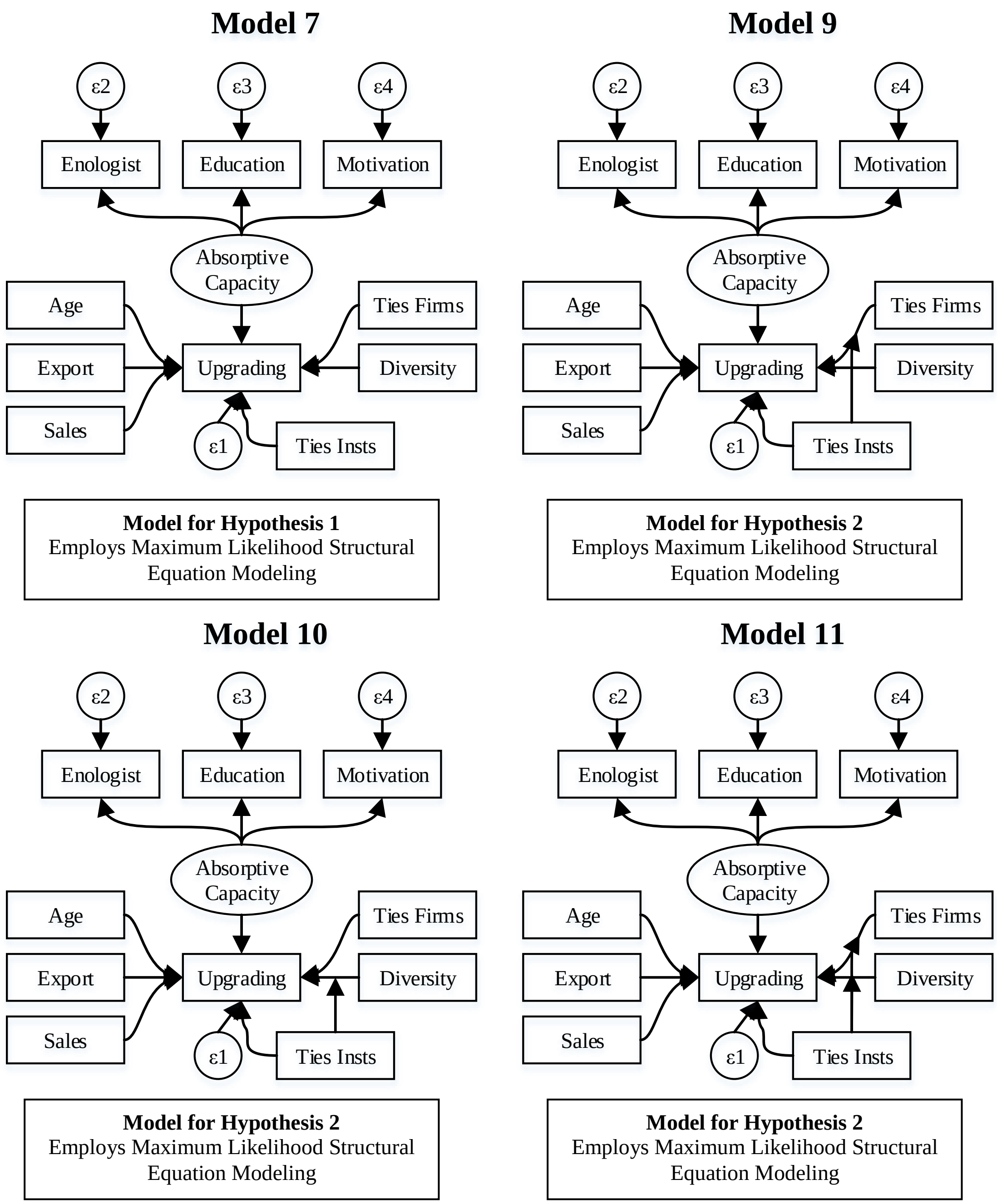
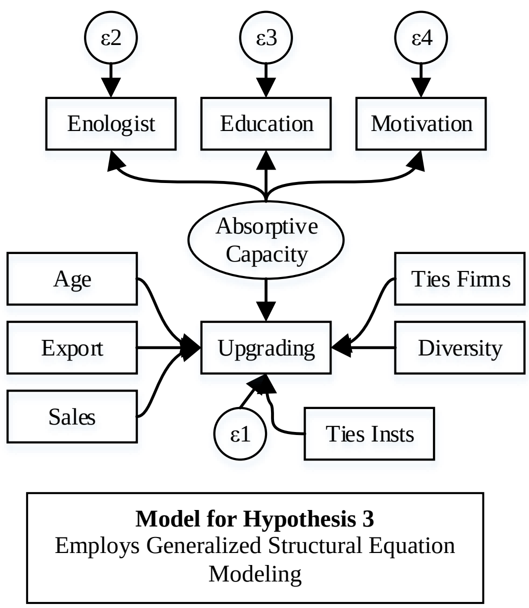
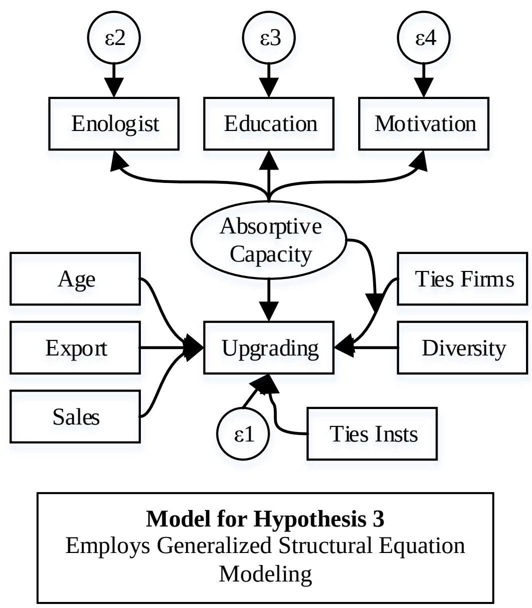


Figure 3.3: Selected Model Diagrams

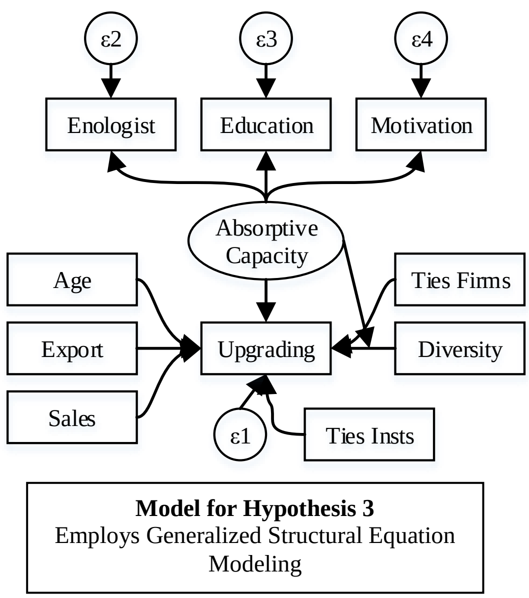
Model 12



Model 13



Model 14



Model 15

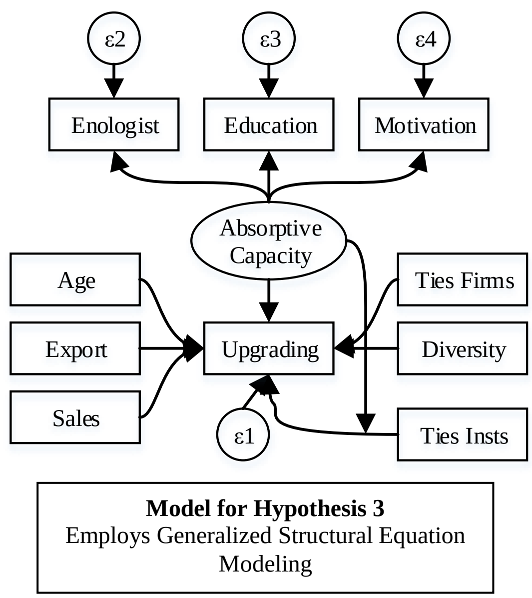


Figure 3.3 (cont): Selected Model Diagrams

Chapter 4: Results

Section 4.1 Interpreting SEM Results

The output of the structural equation modeling combines several elements that are commonly found in other analysis methods. The formatting of structural equation model results can be divided into three components: the model fit, the structural portion of the model and the measurement portion of the model. This section offers a brief explanation of how to interpret the results.

Table 4.1 is an example of an assessment of model fit. Because maximum likelihood estimation was used for Models 1-8, the interpretation of the first four values in the table are the same as any model using that estimation method. The chi-square and degrees of freedom are used to calculate the corresponding p-value. Any model with a p-value greater than 0.05 is considered a good fit for the data, as this indicates we did not significantly fail to reproduce the covariance matrix (Acock, 2013). The remaining metrics are further indicators of model fit. There is a some debate about the use of the non chi-square metrics as means of evaluating model fit (McIntosh, 2012; Herzon and Boomsma, 2009; Savalei and Bentler, 2006) because they are not statistically valid, but as their presentation is common in papers on structural equation modeling and because they are being used in conjunction with the chi-square metric, they have been included here.

RMSEA, root mean squared error of approximation, is a measure of error relative to the number of degrees of freedom. This metric indicates a good fit if it is below 0.05. Since the degrees of freedom are in the denominator, this metric penalizes models that are over specified (Acock, 2013).

CFI, the comparative fit index, compares models to a baseline model that assumes no relationship between variables. The metric is an indication of how much better the model does at explaining the covariance matrix than one in which all items are unrelated. CFI can be interpreted as a percentage. The standard cutoff for this metric is between 0.90 and 0.95, with larger values being favored (Acock, 2013).

The final measure of fit is the standardized root mean squared residual, SRMR. This is a measure of how close the model reproduces each correlation, on average, with smaller values being favored. While SRMR values of less than 0.05 are considered good, they are dependent on the level of correlation in the model variables. If the average correlation in a model was 0.10, then a SRMR of 0.05 would be ±50%, whereas with a model with an average correlation of 0.50, then a SRMR of 0.05 would be ±10% (Acock, 2013).

The structural portion of the model is seen in the first part of Table 4.2, the parameter estimates. These coefficients are typically reported with a regression model and incorporate the p-value to indicate the level of significance of the coefficient. The difference with structural equation modeling is the inclusion of both unstandardized and standardized coefficients. The unstandardized version represents the literal interpretation of the relationship. For instance, in Table 4.2 Model 1, the coefficient for age is -0.037, this means that for every extra year a firm has been in business, there is a 0.037 reduction in the product upgrading variable. The unstandardized solution fixes a coefficient at one to serve as the reference indicator, whereas the standardized solution fixes the variance of all variables at one. The standardized coefficient represents the strength of the association, with larger values indicating a stronger relationship. By reporting both versions, both the form and strength of the relationship can be understood (Acock, 2013).

Another part of the structural model is the model R-square. Like in ordinary least squares regression, this value represents the amount of variance explained in a dependent variable. Because multiple variables are explained in the model, there are multiple R-square values. Reported here are the two variables of interest for this thesis: the variance explained in the dependent variable, product upgrading, and the variance explained in the model as a whole.

The measurement portion of the model is displayed in the bottom half of Table 4.2, the loadings on Absorptive Capacity. Similar to other forms of factor analysis, structural equation modeling produces factor loadings on the latent variable, but with the added benefit of providing standard errors to allow for a z-test. This allows for the determination of whether a loading is statistically significant (Acock, 2013).

The error variances for each dependent variable are also typically reported. As they are not referenced directly in the paper, they have been moved to the appendix in full table format.

Section 4.2 Model Validation

The first series of specifications validate the use of each of the controls in the model. While each of the control variables has theoretical basis for being in the model, the limited sample size and in some cases, degree of correlation with the independent variables, make it crucial to support the inclusion of each element in the model.

The first model includes all control and predictor variables and is similar to the regression found in McDermott, Corredoira and Kruse (2009). This is the unrestricted model. Absorptive capacity, as expected, is positive (1.198) and significant at the 0.05 level. Additionally, education and motivation (0.619, 0.725) have significant loadings at the 0.01 level on absorptive capacity. The only other variable that is significant is the dummy indicating wineries located in the Valley de Uco (-0.934). Being located in this area has significantly negative impact on product upgrading. The impact of both ties to firms and ties to institutions (0.237, 0.297) were both in the expected positive direction, though neither were significant at the 0.10 level.

The overall assessment of the initial model fit is good, with a chi-squared p-value of 0.225, indicating that the model does not significantly fail to reproduce the covariance matrix. The other key indicators of model fit are all within the desired range, with RMSEA below 0.05, CFI above 0.90 and SRMR below 0.05. Overall, the model explains almost 82% of the variance, and over 58% of the variance in product upgrading, which is similar to the results reported by McDermott, Corredoira and Kruse (2009).

With many of the control variables being insignificant, I endeavoured to validate that their inclusion improves the model. The covariance among the number of ties to firms and non-firm, non-institution organizations were both high in the first model. This makes sense if wineries are connecting with other firms and organizations in their own zone, making for a close, dense network, as was observed by McDermott, Corredoira and Kruse (2009). While the impact that geography has over the number, quality, and type of ties a firm has to other organizations is an important question, it is not the primary focus of this research. Additionally, changes in technology and communication will continue to make physical restrictions less of a factor in a firm's network. This is the first aspect I chose to validate. The results were in line with expectations. Because there was no longer a series of variables with a reasonably high correlation to ties to firm, the coefficient (0.288) both increased and became statistically significant at the 0.05 level. Absorptive capacity appears to have an impact on the dependent variable (3.145, significant at 0.01 level). Running a likelihood ratio test between the two nested models reveals a statistically insignificant value, meaning the restricted model - without the geographic dummies - did not perform significantly worse than the unrestricted model. Additionally, all key indicators of model fit were in the desired ranges. Most performed better than the unrestricted model. There was, however, a strong drop in the ability of the model to explain the variance in the dependent variable, with a new R-square value of 0.407. Because of the complexity of the model relative to the number of observations and because of the improvements to my metrics of model fit, I chose the simplified model that excluded geographic dummies treated the new model as the base unrestricted model.

The rest of the initial models test the remaining variables and systematically determines whether to include or exclude them in the model. The first excluded variable measures the geographic diversity of firms. Removing this variable from the model had effect impact on the coefficients and did not change the significance level of any variable. The likelihood ratio test between Model 3 and Model 2 was again insignificant, suggesting that this models was more restrictive yet did not do significantly worse than Model 2. Again, all indicators of model fit were within the desired range, but all were worse than with Model 2.

Models 4-6 also exclude the diversity variable and test the exclusion of firm age, share of revenue from exports and level of foreign direct investment, respectively. The results for all were similar in that they did not affect the level of significance or greatly alter the coefficients or loadings of any of the other variables. Additionally, likelihood ratio tests revealed that none of the models did significantly worse than Model 2 or Model 3. However, removing the age variable and export variable both resulted in RMSEA and SRMR values above 0.05, which is the upper bound for a model with a good fit. While the chi-square values for both were well above the desired Chi-square level of 0.05, I decided to leave these variables in the model to maintain the best possible model fit and predictive power.

The variable for FDI was a different matter, however. Excluding this variable, while not making the model significantly worse, did improve all measures of model fit. Looking at the variable logically, we see that only 10% of the firms had equity above 10% from foreign firms (the definition of FDI). Because there were so few foreign-owned firms, I decided to exclude this variable from the model. As an additional test, I then ran a model with only the geographic dummies and the FDI variables excluded. The resulting model did not perform significantly worse than Model 2 and had the best estimates across almost all the indicators when compared with any of the models discussed so far.

As a final test of variables to include in the model, Model 8 excludes the variable that indicated ties to non-firm, non-institution entities. As this variable is an amalgam of different organizational types that would be consulted for a multitude or reasons, and because it had not yet been statistically significant, it seemed reasonable to exclude this variable. A likelihood ratio test compared to Model 7 revealed that this model did not do significantly worse; however, the resulting RMSEA and SRMR values were above the desired 0.05, I thus decided to include ties to non-firm, non-institution entities in future models. The final model, Model 7, excluded all geographic dummies and the dummy for FDI. The results confirmed some of the elements of the first hypothesis, in that ties to other firms and a firm's absorptive capacity both had strong, positive impacts on product upgrading. Ties to institutions, which in an ideal state would both help a firm process information and act as an aggregator of knowledge, did not have the impact that was expected, as it was both negative and statistically insignificant.

Section 4.3 Impact of Ties to Institutions

The hypothesis around the impact of institutions was twofold, they would both provide a source of information for firms and they would help firms process the information that they were receiving. The initial results did not show that connections to institutions alone influenced product upgrading, suggesting that the institutions in and of themselves do not provide the resources needed to accomplish product upgrading.

Table 4.1: Model Fit Metrics - Baseline

	N	X²	df	p	RMSEA	CFI	SRMR
Model 1 - All Zones	93	31.081	26	0.225	0.046	0.947	0.042
Model 2 - No Zones	93	20.600	18	0.300	0.039	0.968	0.045
Model 3 - No Zones, no Diversity	93	18.907	16	0.274	0.044	0.965	0.048
Model 4 - No Zones, no Diversity, no Age	93	18.132	14	0.201	0.056	0.952	0.051
Model 5 - No Zones, no Diversity, no Export	93	18.665	14	0.178	0.060	0.943	0.052
Model 6 - No Zones, no Diversity, no FDI	93	16.450	14	0.287	0.043	0.970	0.051
Model 7 - No Zones, no FDI	93	18.094	16	0.318	0.038	0.974	0.047
Model 8 - No Zones, no FDI, no Ties MFI	93	17.468	14	0.232	0.052	0.957	0.051

Table 4.2: Model Validation with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 1		**Model 2**		**Model 3**	
	Unstandardized	Standardized	Unstandardized	Standardized	Unstandardized	Standardized
Parameter Estimates						
Este	-3.514	-0.235				
San Juan	-2.564	-0.142				
Sur	-4.801	-0.252				
Uco	-18.868**	-0.934**				
Age	-0.037	-0.100	-0.047	-0.127	-0.046	-0.126
Export	-0.107	-0.424	-0.038	-0.150	-0.039	-0.154
Diversity	-5.130	-0.166	-1.202	-0.039		
FDI	1.024	0.041	-0.440	-0.018	-0.315	-0.013
Sales	-0.849	-0.223	-0.493	-0.130	-0.492	-0.130
Ties MFI	-0.185	-0.183	-0.100	-0.100	-0.129	-0.128
Ties Firms	0.166	0.237	0.202**	0.288**	0.213**	0.304**
Ties Insts	0.243	0.297	-0.286	-0.350	-0.286	-0.350
Absorptive Capacity (Latent)	1	1.198**	1	0.904**	1	0.900**
Constant	28.679***	4.095***	22.023***	3.145***	21.460***	3.064***
Loadings						
Enologist	0.015	0.157	0.017	0.128	0.016	0.124
Education	0.180*	0.619***	0.252**	0.653***	0.253**	0.652***
Motivation	0.275*	0.725***	0.351**	0.697***	0.353**	0.698***
R-Squared						
Upgrading		0.581		0.407		0.406
Model		0.819		0.740		0.740

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

Table 4.2 (cont): Model Validation with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 4		Model 5		Model 6	
	Unstandardized	Standardized	Unstandardized	Standardized	Unstandardized	Standardized
Parameter Estimates						
Este						
San Juan						
Sur						
Uco						
Age			-0.034	-0.093	-0.046	-0.124
Export	-0.027	-0.108			-0.039	-0.155
Diversity						
FDI	-0.298	-0.012	-1.428	-0.057		
Sales	-0.527	-0.139	-0.508	-0.134	-0.488	-0.128
Ties MFI	-0.137	-0.136	-0.082	-0.082	-0.128	-0.127
Ties Firms	0.221**	0.315***	0.221**	0.314***	0.214**	0.304**
Ties Insts	-0.272	-0.333	-0.284	-0.347	-0.281	-0.344
Absorptive Capacity (Latent)	1	0.886**	1	0.822***	1	0.891***
Constant	20.375***	2.909***	20.247***	2.891***	21.372***	3.052***
Loadings						
Enologist	0.016	0.119	0.018	0.127	0.016	0.123
Education	0.257**	0.651***	0.281**	0.660***	0.251**	0.640***
Motivation	0.359**	0.700***	0.382**	0.690***	0.363**	0.711***
R-Squared						
Upgrading		0.391		0.392		0.406
Model		0.734		0.733		0.742

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

Table 4.2 (cont): Model Validation with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 7		Model 8	
	Unstandardized	Standardized	Unstandardized	Standardized
Parameter Estimates				
Este				
San Juan				
Sur				
Uco				
Age	-0.046	-0.125	-0.048	-0.129
Export	-0.039	-0.153	-0.035	-0.138
Diversity	-1.052	-0.034	-2.615	-0.085
FDI				
Sales	-0.489	-0.129	-0.544	-0.143
Ties MFI	-0.102	-0.102		
Ties Firms	0.204**	0.290**	0.185**	0.264**
Ties Insts	-0.281	-0.343	-0.309*	-0.378*
Absorptive Capacity (Latent)	1	0.892***	1	0.876***
Constant	21.854***	3.121***	22.541***	3.219***
Loadings				
Enologist	0.016	0.124	0.018	0.132
Education	0.251**	0.640***	0.256**	0.642***
Motivation	0.362**	0.711***	0.367**	0.707***
R-Squared				
Upgrading		0.406		0.406
Model		0.742		0.741

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

The next set of models examined the impact of institutions on information firms bring in from outside sources, in this case other firms.

Model 9 first tested the interacting ties to institutions with ties to firms. The resulting model showed a negative impact (-0.587) at the 0.05 level for ties to institutions on product upgrading. Both ties to firms and the interaction with ties to institutions were positive (0.202, 0.354), but insignificant. The fact that the ties to institutions became negative while the interaction remained positive suggests that there may be some support for the hypothesis that institutions are helping firms process the information they receive from other firms, but the results are far from conclusive.

The overall model results from Model 9 were strong, with a chi-square p-value of 0.389. All estimates are within the desired range. The addition of the interaction did not greatly increase the amount of variance explained in the model as a whole compared with Model 7, going from 74.2% to 74.8%. Nevertheless, it did increase the amount of variance explained in the dependent variable to 42.1% from 40.6%. However, a likelihood ratio test did result in Model 7 not performing significantly worse than Model 9, suggesting that model 9 is not a significantly improved model.

Model 10 interacts ties to institutions to the variable indicating the geographic diversity of firm ties. The hypothesis is that a wide array of information from sources outside a firm's existing circle of knowledge leads to firm upgrading and that institutions could be a filter and interpreter of that new information. Interestingly, ties to institution became strongly positive (2.551) and significant at the 0.05 level, with the interaction term with the diversity variable being strongly negative (-3.315) and significant at the 0.01 level. This is counter to the hypothesis and to previous results. That the ties to institutions revered the sign and the interaction with diversity was so strongly negative suggests that bringing a wide diversity of information into a relationship with an institution may actually be an impediment to product upgrading. This may makes sense in the context of wine making, where climate conditions may impact the ability to implement new information from sources outside one's own location, but it does not appear that institutions help to deal with this issue. As for the level of the model to predict the covariance matrix, all indicator values were within range, with 51% of the variance in the dependent variable being explained.

The final model in this analysis, Model 11, utilized both interaction variables to see if the results would change. The results were similar to Model 10, with ties to institutions strongly positive (2.452) and significant at the 0.05 level and its interaction with diversity being strongly negative (-3.560) and significant at the 0.01 level. A likelihood ratio test for Model 7 showed that the more restricted model did not do significantly worse, so the added interaction variables did not add to the model's ability to predict the covariance matrix.

From these results, it appears models contradicted the hypothesis that ties to institutions would improve the ability of a firm to utilize geographically diverse information to improve products. It did suggest that there may be some validity to the hypothesis that institutions help interpret information that comes from other firms, but the results were not conclusive.

Table 4.3: Model Fit Metrics - Impact of Ties to Institutions

	N	X²	df	p	RMSEA	CFI	SRMR
Model 9 - Ties Insts interaction w/ Ties Firms	93	19.040	18	0.389	0.025	0.987	0.044
Model 10 - Ties Insts interaction w/ Diversity	93	21.096	18	0.275	0.043	0.965	0.047
Model 11 - Ties Insts interaction w/ Ties Firms and Diversity	93	21.731	20	0.355	0.031	0.981	0.044

Table 4.4: Impact of Ties to Institutions with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 9		**Model 10**		**Model 11**	
	Unstandardized	Standardized	Unstandardized	Standardized	Unstandardized	Standardized
Parameter Estimates						
Age	-0.043	-0.117	-0.057	-0.156	-0.054	-0.147
Export	-0.044	-0.174	-0.037	-0.145	-0.044	-0.174
Diversity	-0.642	-0.021	-9.177	-0.297	-9.277	-0.300
Sales	-0.557	-0.147	-0.623	-0.164	-0.728	-0.192
Ties MFI	-0.173	-0.171	0.588*	0.583*	0.547*	0.542*
Ties Firms	0.142	0.202	0.019	0.027	-0.085	-0.122
Ties Insts	-0.480**	-0.587**	2.086**	2.551**	2.005**	2.452**
Ties Insts X Ties Firms	0.015	0.354			0.021	0.506
Ties Insts X Diversity			-3.948***	-3.315***	-4.286***	-3.560***
Absorptive Capacity (Latent)	1	0.873***	1	0.985***	1	0.964***
Constant	23.027***	3.288***	25.321	3.616***	27.261***	3.893***
Loadings						
Enologist	0.017	0.124	0.017	0.144	0.018	0.145
Education	0.256**	0.670***	0.233**	0.657***	0.237**	0.655***
Motivation	0.370**	0.711***	0.318**	0.690***	0.326**	0.691***
R-Squared						
Upgrading		0.421		0.510		0.539
Model		0.748		0.784		0.797

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

Section 4.4 Impact of Firm Absorptive Capacity

The last hypothesis focuses on a firm's internal capacity to drive product upgrading through interpreting information by examining how the absorptive capacity latent variable interacted with ties to firms, geographic diversity of firm connections and ties to institutions. The idea being that firms with higher levels of knowledge and greater motivation to upgrade products would receive a greater benefit from their ties and the diversity of information they receive. To run models that interacted the latent variable with measured variables, they had to be specified differently in Stata 13, using the GSEM (Generalized Structural Equation Modeling) command. The different command does not provide many of the result options present for the simple linear version of the SEM command, and thus cannot provide an assessment of model fit. But it does provide the unstandarized coefficients, loadings and error variances. To provide a baseline of comparison for the remaining models, Model 12 repeats the specification of Model 7 using the generalized approach. While the coefficients were slightly different, the same variables were again significant using this method, ties to firms and absorptive capacity, with education and motivation both loading significant at the 0.01 level and positive (0.373, 0.618) on absorptive capacity.

Model 13 looked at the impact of absorptive capacity on ties to firms. The interaction variable was positive (0.048), but insignificant. In addition, the loadings on absorptive capacity (0.609, 0.993) are no longer significant and ties to firms are significant at the 0.05 level and positive (0.168). Overall, the model does not confirm the hypothesis that firms with a greater absorptive capacity would be more likely to upgrade based on their ties to firms.

Model 14 looked at the interaction between absorptive capacity and the geographic diversity of firm ties. The resulting model revealed no significant effect for product upgrading and also reduced the significance of the loadings on absorptive capacity. While all values were positive, the model does not support the hypothesis that absorptive capacity would enhance product upgrading given a diverse set of ties to firms.

Model 15 looked at the interaction between absorptive capacity and ties to institutions. The results were similar to that of Model 13, with only ties to firms being a significant driver of product upgrading (0.160, significant at 0.05 level). Again, the hypothesis that absorptive capacity would allow a firm to make the most of its relationships was not supported by the model.

While firm knowledge and motivation proved to be significant in and of itself in driving product upgrading in Models 1-11, the hypothesis that firms with greater absorptive capacity would benefit more from their relationships was not supported in Models 13-15.

Table 4.5: Impact of Absorptive Capacity with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 12	Model 13	Model 14	Model 15
	Unstandardized	**Unstandardized**	**Unstandardized**	**Unstandardized**
Parameter Estimates				
Age	-0.038	-0.035	-0.038	-0.040
Export	0.018	0.014	0.017	0.021
Diversity	-0.849	-1.080	-0.068	-2.648
Sales	-0.181	-0.255	-0.189	-0.189
Ties MFI	0.054	0.036	-0.029	0.110
Ties Firms	0.168**	0.168**	0.0172	0.160**
Ties Insts	-0.105	-0.124	-0.109	-0.070
Absorptive Capacity X Ties Firms		0.048		
Absorptive Capacity X Diversity			0.405	
Absorptive Capacity X Ties Insts				-0.017
Absorptive Capacity (Latent)	1	1	1	1
Constant	18.067***	18.636***	17.788***	18.608***
Loadings				
Enologist	0.026	0.046	0.031	0.026
Education	0.373***	0.609	0.438	0.318***
Motivation	0.618***	0.993	0.735	0.486***

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

Chapter 5: Conclusion

The objective of this thesis was to gain a deeper understanding of the factors that drive upgrading in the Argentine wine industry. I take a holistic look at how firms learn from outside sources based on their internal resources. In their analysis of the survey data, McDermott, Corredoira and Kruse (2009) found that a greater number of ties to both firms and institutions helped wineries achieve product upgrading. This thesis found a similar result in regard to ties to firms, but not in regard to ties to institutions. A reason for the differences could lie in the latent variable tested and how it was correlated to institutional ties. The previous work did not find significant increases in product upgrading from higher levels of education and enologists. The variables for education and motivation are both strongly correlated with ties to institutions (0.44 and 0.45, respectively). Moreover, they are consistently significant drivers of product upgrading. The latent variable constructed from these factors also had a significant, positive covariance value with ties to institutions. This appears to suggest that a highly motivated and educated firm is more likely to seek assistance from an institution. They tend to see success because of all factors, although the impact of each individual factor is not certain.

Most of the explanatory variables had some correlation with each other. With a limited number of variables available from the survey, there were not many ways to control correlation. This thesis attempted to address this problem through the use of structural equation modeling. This methodology, while not commonly used in network analyses, provides the ability to account for higher level factors that are not directly capture by the data, a common problem in survey data and subsequently the field of firm network analysis which often relies of surveys to collect firm level data.

An additional challenge with the survey data was the limited number of firms surveyed. The initial research was accompanied by an in-depth qualitative analysis of the wine industry in Argentina, which provided additional insight to the analysis. Where this analysis could benefit most is through an expansion of the survey. In the present analysis, the limited number of observations pushed the limits of structural equation modeling and prevented deeper, more rigorous modeling. Even so, the empirical work in this thesis yielded models with a strong fit and coefficients that were reasonably consistent across model specifications.

A second way to improve the survey would be to focus on how the wineries are tied to other organizations. The survey only allows for counts of organization type to develop the total number of ties, but this does not control for things like the strength of a relationship or the level of dependence on the relationship. Past research has showed that the degree to which two firms are embedded and the level of trust affects the quantity and quality of information that is shared.

This thesis illustrated the influence of firm education and motivation on the ability to upgrade, but was unable to identify other factors that help drive the process. How and from whom or where do firms acquire the knowledge to improve their products? In an age where information is abundant and fluid, being able to interpret information is likely going to become increasingly important. We need to have a deeper understanding of the best sources for obtaining that information. To do this, further research is needed to assess how individual firms can best set up an external network to support their efforts. While this thesis found that firms with high levels of education and motivation typically upgraded more often, how can firms that lack some of these internal resources remain competitive? McDermott, Corredoira and Kruse (2009; 2010) showed that informational diversity in the form of network centrality and geographic diversity were important factors in product upgrading. A better understanding of what types of firms best foster learning is needed to advance this research. We need to explore whether firms benefit most from interacting with firms that share qualities — including geography/climate, quantity of sales, and product offerings. Alternatively, it may be more beneficial for firms to incorporate a more diverse set of information. Understanding the value of network connections may be beneficial for individual firms and help associations and institutions better serve their members as hubs of information and experience.

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Appendix A: Complete Tables

Table A.1: Model Fit Metrics - Baseline

	N	X²	df	p	RMSEA	CFI	SRMR
Model 1 - All Zones	93	31.081	26	0.225	0.046	0.947	0.042
Model 2 - No Zones	93	20.600	18	0.300	0.039	0.968	0.045
Model 3 - No Zones, no Diversity	93	18.907	16	0.274	0.044	0.965	0.048
Model 4 - No Zones, no Diversity, no Age	93	18.132	14	0.201	0.056	0.952	0.051
Model 5 - No Zones, no Diversity, no Export	93	18.665	14	0.178	0.060	0.943	0.052
Model 6 - No Zones, no Diversity, no FDI	93	16.450	14	0.287	0.043	0.970	0.051
Model 7 - No Zones, no FDI	93	18.094	16	0.318	0.038	0.974	0.047
Model 8 - No Zones, no FDI, no Ties MFI	93	17.468	14	0.232	0.052	0.957	0.051

Table A.2: Baseline Model with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 1		**Model 2**		**Model 3**	
	Unstandardized	Standardized	Unstandardized	Standardized	Unstandardized	Standardized
Parameter Estimates						
Este	-3.514	-0.235				
San Juan	-2.564	-0.142				
Sur	-4.801	-0.252				
Uco	-18.868**	-0.934**				
Age	-0.037	-0.100	-0.047	-0.127	-0.046	-0.126
Export	-0.107	-0.424	-0.038	-0.150	-0.039	-0.154
Diversity	-5.130	-0.166	-1.202	-0.039		
FDI	1.024	0.041	-0.440	-0.018	-0.315	-0.013
Sales	-0.849	-0.223	-0.493	-0.130	-0.492	-0.130
Ties MFI	-0.185	-0.183	-0.100	-0.100	-0.129	-0.128
Ties Firms	0.166	0.237	0.202**	0.288**	0.213**	0.304**
Ties Insts	0.243	0.297	-0.286	-0.350	-0.286	-0.350
Absorptive Capacity (Latent)	1	1.198**	1	0.904**	1	0.900**
Constant	28.679***	4.095***	22.023***	3.145***	21.460***	3.064***
Loadings						
Enologist	0.015	0.157	0.017	0.128	0.016	0.124
Education	0.180*	0.619***	0.252**	0.653***	0.253**	0.652***
Motivation	0.275*	0.725***	0.351**	0.697***	0.353**	0.698***
Error Variance						
Upgrading	20.548	0.419	29.098	0.593	29.147	0.594
Enologist	0.664	0.975	0.670	0.984	0.670	0.985
Education	3.692	0.617	3.431	0.574	3.435	0.574
Motivation	4.816	0.475	5.215	0.514	5.199	0.512
R-Squared						
Upgrading		0.581		0.407		0.406
Model		0.819		0.740		0.740

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

Table A.2 (cont): Baseline Model with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 4		Model 5		Model 6	
	Unstandardized	Standardized	Unstandardized	Standardized	Unstandardized	Standardized
Parameter Estimates						
Este						
San Juan						
Sur						
Uco						
Age			-0.034	-0.093	-0.046	-0.124
Export	-0.027	-0.108			-0.039	-0.155
Diversity						
FDI	-0.298	-0.012	-1.428	-0.057		
Sales	-0.527	-0.139	-0.508	-0.134	-0.488	-0.128
Ties MFI	-0.137	-0.136	-0.082	-0.082	-0.128	-0.127
Ties Firms	0.221**	0.315***	0.221**	0.314***	0.214**	0.304**
Ties Insts	-0.272	-0.333	-0.284	-0.347	-0.281	-0.344
Absorptive Capacity (Latent)	1	0.886**	1	0.822***	1	0.891***
Constant	20.375***	2.909***	20.247***	2.891***	21.372***	3.052***
Loadings						
Enologist	0.016	0.119	0.018	0.127	0.016	0.123
Education	0.257**	0.651***	0.281**	0.660***	0.251**	0.640***
Motivation	0.359**	0.700***	0.382**	0.690***	0.363**	0.711***
Error Variance						
Upgrading	29.850	0.609	29.832	0.608	29.140	0.594
Enologist	0.671	0.986	0.670	0.984	0.670	0.985
Education	3.444	0.576	3.373	0.564	3.529	0.590
Motivation	5.170	0.510	5.316	0.524	5.019	0.495
R-Squared						
Upgrading		0.391		0.392		0.406
Model		0.734		0.733		0.742

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

Table A.2 (cont): Baseline Model with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 7		Model 8	
	Unstandardized	Standardized	Unstandardized	Standardized
Parameter Estimates				
Este				
San Juan				
Sur				
Uco				
Age	-0.046	-0.125	-0.048	-0.129
Export	-0.039	-0.153	-0.035	-0.138
Diversity	-1.052	-0.034	-2.615	-0.085
FDI				
Sales	-0.489	-0.129	-0.544	-0.143
Ties MFI	-0.102	-0.102		
Ties Firms	0.204**	0.290**	0.185**	0.264**
Ties Insts	-0.281	-0.343	-0.309*	-0.378*
Absorptive Capacity (Latent)	1	0.892***	1	0.876***
Constant	21.854***	3.121***	22.541***	3.219***
Loadings				
Enologist	0.016	0.124	0.018	0.132
Education	0.251**	0.640***	0.256**	0.642***
Motivation	0.362**	0.711***	0.367**	0.707***
Error Variance				
Upgrading	29.107	0.594	29.149	0.594
Enologist	0.670	0.985	0.669	0.982
Education	3.529	0.590	3.512	0.587
Motivation	5.023	0.495	5.078	0.500
R-Squared				
Upgrading		0.406		0.406
Model		0.742		0.741

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

Table A.3: Model Fit Metrics - Impact of Ties to Institutions

	N	X²	df	p	RMSEA	CFI	SRMR
Model 9 - All Zones	93	31.081	26	0.225	0.046	0.947	0.042
Model 10 - No Zones	93	20.600	18	0.300	0.039	0.968	0.045
Model 11 - No Zones, no Diversity	93	18.907	16	0.274	0.044	0.965	0.048

Table A.4: Impact of Ties to Institutions with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 9		**Model 10**		**Model 11**	
	Unstandardized	Standardized	Unstandardized	Standardized	Unstandardized	Standardized
Parameter Estimates						
Age	-0.043	-0.117	-0.057	-0.156	-0.054	-0.147
Export	-0.044	-0.174	-0.037	-0.145	-0.044	-0.174
Diversity	-0.642	-0.021	-9.177	-0.297	-9.277	-0.300
Sales	-0.557	-0.147	-0.623	-0.164	-0.728	-0.192
Ties MFI	-0.173	-0.171	0.588*	0.583*	0.547*	0.542*
Ties Firms	0.142	0.202	0.019	0.027	-0.085	-0.122
Ties Insts	-0.480**	-0.587**	2.086**	2.551**	2.005**	2.452**
Ties Insts X Ties Firms	0.015	0.354			0.021	0.506
Ties Insts X Diversity			-3.948***	-3.315***	-4.286***	-3.560***
Absorptive Capacity (Latent)	1	0.873***	1	0.985***	1	0.964***
Constant	23.027***	3.288***	25.321	3.616***	27.261***	3.893***
Loadings						
Enologist	0.017	0.124	0.017	0.144	0.018	0.145
Education	0.256**	0.670***	0.233**	0.657***	0.237**	0.655***
Motivation	0.370**	0.711***	0.318**	0.690***	0.326**	0.691***
Error Variance						
Upgrading	28.391	0.579	24.052	0.490	22.602	0.461
Enologist	0.670	0.985	0.666	0.979	0.666	0.979
Education	3.533	0.591	3.397	0.568	3.414	0.571
Motivation	5.015	0.494	5.323	0.525	5.298	0.522
R-Squared						
Upgrading		0.421		0.510		0.539
Model		0.748		0.784		0.797

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level

Table A.5: Impact of Absorptive Capacity with Parameter Estimates for Product Upgrading as the Dependent Variable and Loadings on Absorptive Capacity

	Model 12	Model 13	Model 14	Model 15
	Unstandardized	**Unstandardized**	**Unstandardized**	**Unstandardized**
Parameter Estimates				
Age	-0.038	-0.035	-0.038	-0.040
Export	0.018	0.014	0.017	0.021
Diversity	-0.849	-1.080	-0.068	-2.648
Sales	-0.181	-0.255	-0.189	-0.189
Ties MFI	0.054	0.036	-0.029	0.110
Ties Firms	0.168**	0.168**	0.0172	0.160**
Ties Insts	-0.105	-0.124	-0.109	-0.070
Absorptive Capacity X Ties Firms		0.048		
Absorptive Capacity X Diversity			0.405	
Absorptive Capacity X Ties Insts				-0.017
Absorptive Capacity (Latent)	1	1	1	1
Constant	18.067***	18.636***	17.788***	18.608***
Loadings				
Enologist	0.026	0.046	0.031	0.026
Education	0.373***	0.609	0.438	0.318***
Motivation	0.618***	0.993	0.735	0.486***
Error Variance				
Upgrading	31.761	28.854	31.606	29.840
Enologist	0.679	0.678	0.679	0.675
Education	3.944	4.001	3.974	3.798
Motivation	4.751	5.081	4.713	5.250

* - Significant at the 10% level; ** - Significant at the 5% level; *** - Significant at the 1% level